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ABSTRACT

The "New York State School Report Card" provides a vehicle for benchmarking with respect to student achievement. In this study, additional tools were developed for making external comparisons with respect to achievement, and tools were added for assessing fiscal policy and efficiency. Data from school years 1993-94 through 1995-96 were used for 101 school districts and their schools in the western part of New York state. Two types of outcome measures were developed: average student achievement, measured by four factor scores at the district level and six average scores at the school level, and average school and district effect, estimated through a multiple regression procedure that removes the covariation of family and environmental characteristics from the student achievement scores. School district efficiency was measured through a linear programming technique known as data envelopment analysis. Standard scores were developed and used to prepare benchmarking charts for analyzing student performance on 15 performance measures at the school level. As with most studies of relationships between student outcomes and expenditures, there was no statistically significant correlation between school district effect and expenditure. Adding school district effect and school district efficiency to the outcome usually considered in school comparisons, academic achievement, highlights the differences in challenges that school districts face, and shows that many districts, not normally recognized for their effectiveness, are making important contributions to the intellectual development of their students. Three appendixes contain score charts. (Contains 7 tables, 41 figures, and 68 references.) (SLD)

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Benchmarking:
A Study of School and School District Effect and Efficiency

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The authors deeply appreciation the contributions of time and intelligence provided by those persons who served on the study's Advisory Committee. The Committee met three times, April 21, 1997, November 27, 1997 and November 13, 1998, to provide the research staff with recommendations concerning the kinds of information about school outcomes and inputs that would be helpful to them, improving the clarity and accuracy of the reporting devices, and issues surrounding the format and content of the final report, its public release, and the utility of continuing similar analyses on a regular basis. While acknowledging the value of the advice provided by the Committee, the authors assume full responsibility for the content of the report; participation on the Advisory Committee in no way constitutes an endorsement of the report. Members of the Advisory Committee were: Ms. Marva Daniel, Principal, Futures Academy, Buffalo; Dr. Calvin Deyermond, Assistant Superintendent for Curriculum Instruction, North Tonawanda; Ms. Marta Herzbrun, Western District Parent and Teachers Association (PTA); Mr. Thomas Hill, Executive Director, Center for Competitiveness; Ms. Judy Huber, Executive Director, Erie County Association of School Boards; Mr. Donald King, Niagara Falls School Board; Dr. Paul Lafornara, Principal, City Honors Academy, Buffalo; Ms. Patricia Lerner, League of Women Voters; Dr. Lionel Meno, District Superintendent, Erie #2, Chautauqua and Cattaraugus BOCES; Professor Jan Mutchler, Sociology Department, University at Buffalo; Dr. Ronald O'Brian, Associate Superintendent for Instruction, Buffalo; Mr. Donald Ogilvie, District Superintendent, Erie #1 BOCES; Mr. Jerome Poplawski, School Boad, Cheektowaga; Mr. Philip Rumore, President, Buffalo Teachers Federation, Inc.; Mr. Ronald Uba, Regional Staff Director, New York State United Teachers; Mr. Dave Van Scoy, Superintendent (Retired), Batavia; Ms. Marlies Wesolowski, Buffalo School Board; and, Ms. Cynthia Worth, Western District Parent and Teacher Association (PTA). Others who critiqued the first draft of the final report include: Mr. Joseph Backer, Superintendent, Letchworth; Dr. Ronald Black, Principal, Akron High School; Dr. Vincent Coppola, Executive Director, Western New York Educational Service Council; Dr. Richard Hitzges, Assistant Superintendent for Financial and Management Services, Williamsville; Mr. Michael Kunz, Principal, Cuba Elementary School; Mr. Thomas Maturski, Treasurer, Hamburg; and, Mr. Bruno Stampone, Vice Principal, Riverside Academy, Buffalo.

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University at Buffalo
June 1999

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Executive Summary

Benchmarking is a form of assessment that establishes external standards to which internal processes may be compared. *The New York State School Report Card* provides a vehicle for benchmarking with respect to student achievement. In this study, we have developed additional tools for making external comparisons with respect to achievement and have added tools for assessing fiscal policy and efficiency, i.e., comparing outcomes (achievement) with the amount of resources consumed in the schooling process.

While this study used data available for the school years 1993-94 through 1995-96, the procedures and reporting devices can be adapted and updated as new information becomes available. Achievement data were obtained from the 1997 *New York State School Report Card* data base. Financial data for the 1995-96 school year were derived from *Financing Our Schools-1997*, prepared by the Erie County No. One Board of Cooperative Educational Services. The cases were limited to the 101 school districts and their schools in the western region of the state containing the two county Buffalo metropolitan area and six rural counties, three of whom contain small cities. The region is geographically about the size of the state of Connecticut and contains approximately 1.5 million people.

Types of Measures Developed

Two types of outcome measures were developed: average student achievement and average school and district effect. Average student achievement is measured by four factor scores at the district level and six average scores at the school level. Both sets of scores combine results of state examinations in reading, writing, mathematics, science and social studies given in grades 3, 4, 5, 6 and 8 and for fifteen Regents examinations given in high school. School district effect is estimated through a multiple regression procedure that statistically removes co-variation of family and environmental characteristics from the student achievement scores. Input measures consist of expenditures (adjusted for within region variations in teacher costs) per pupil units (adjusted for variation in pupil characteristics) and pupil staff ratios. School district efficiency is measured using a linear programming technique known as data envelopment analysis (DEA), a modified quadriform approach, and a ratio approach. School efficiency is measured using the DEA and ratio approaches. The quadriform approach is not used in measuring school efficiency since financial data are not available at that level. The availability of data on staff personnel per pupil enabled the other two approaches to measuring efficiency.

Standard Score Charts

There are many bases for making comparisons, each having its advantages and disadvantages. Comparing ranks within a group of schools or districts is one approach. A basic difficulty with ranks is that the differences in the raw scores of measured attributes between ranks at the extremes are likely to be large when compared to those at the center of a distribution, i. e., there may be little difference of consequence from a policy perspective between ranks of 40 and 60 in a distribution of a hundred cases whereas the difference between ranks of 10 and 1 may be considerable. The problem is reduced only marginally when percentiles, deciles or quartiles are used. These statistics also have the additional disadvantage that they cannot be added, subtracted or averaged. Also, because of the unequal intervals, these statistics are not very useful when comparisons are made among a number of attributes.

To facilitate comparisons on a given attribute (e.g., high school achievement), and across attributes, we have converted the "raw" scores of each distribution to a common metric with the mean equal to zero (0) and the standard deviation equal to one (1) under the assumption that each attribute approximates a distribution bounded by a "normal curve." The conversion results in what is called a *standard score*. Standard scores have an equal interval scale (one standard deviation) and can be aggregated and averaged.

All of the benchmarking charts prepared in this study use standard scores. Charts were developed for analyzing student achievement on fifteen performance measures at the school level for the academic years 1993-94 through 1995-96. One chart each was developed for showing aggregate student achievement and school/district effect at the school and district levels respectively for the academic year 1995-96. Six standard score charts were developed to facilitate assessing district fiscal policy for the academic year 1995-96.

Efficiency Analysis

As with most studies of relationships between student outcomes and expenditures, there was no statistically significant correlation between school district effect and expenditure (r = .15; level of significance, .15). In the quadriform analysis of efficiency, school districts with a school district effect on student achievement more than one standard deviation above the mean (the top 17 per cent of the districts) ranged in expenditure from $3,849 per pupil unit (Panama) to $7,987 (Chautauqua before merger with Mayville), both in Chautauqua County. School districts with a school district effect on student achievement more than one standard deviation below the mean (the lowest 17 per cent of the districts) ranged in expenditure from $3,631 per pupil unit (Falconer) to $5,892 (Maryvale). The difference in expenditure per pupil unit between Falconer and Panama (both in Chautauqua County) is less than $200, yet Panama's district effect on student achievement is more than two standard deviations higher than Falconer's.

Looking at school effect from the standpoint of expenditures, school districts spending more than one standard deviation below the mean range in effect from 1.36 standard deviations above the mean for Akron in Erie County to 2.76 and 2.55 standard deviations below the mean for the Kendall and Albion school districts in Orleans County. The one district spending more than two standard deviations below the mean (Falconer) had a school effect more than one standard deviation below the mean. Districts spending more than one standard deviation above the mean range in effectiveness from 1.94 standard deviations below the mean for Niagara Falls to 1.46 above the mean for Chautauqua (before its merger with Mayville). The two school districts spending more than two standard deviations above the mean (Chautauqua and Barker in Niagara County) had school effects more than one standard deviation above the mean.

There is not perfect agreement among the four efficiency models studied as to which districts are deemed efficient and which are deemed inefficient. This is not wholly unexpected since the DEA technical efficiency model measures a different concept of efficiency (technical) than do the other models (economic). Ten districts were identified as being consistently in the most efficient quartile by all four models (Akron, Frontier, Hinsdale, Letchworth, Lyndonville, Newfane, Panama, Pioneer, Portville, and Springville). Four other districts (Allegany/Limestone, Angelica, Olean and Randolph) were identified as being consistently in the most efficient quartile by the three economic models. Nine districts were identified as being in the least efficient quartile by all four models. Six others were consistently identified as being in the least efficient quartile by the three economic efficiency models.

All of the consistently efficient districts were above average in school effect with an average standard score of +.79. On the other hand, all of their expenditures per pupil need unit were below average with their average being one standard deviation below the mean. The school effect score for all of the consistently inefficient schools was below average with an average standard score for the group of -.74. All of their expenditures per pupil need unit were above average for the sample with the average being one standard deviation above the mean.

School districts in the Buffalo metropolitan area are over-represented in the most efficient quartile according to the technical efficiency model; but they are under-represented in the top quartile according to all three economic efficiency models. Rural districts tend to have lower pupil to teacher ratios than do urban and suburban districts, ranking them lower on technical efficiency. On the other hand, rural districts pay less for their teachers and other staff, giving them an advantage on economic efficiency measures.

At the school level, thirty six elementary schools, thirteen middle schools, five junior/senior high schools and ten high schools were classified as efficient by both models. Of these schools, three were located in Buffalo, seventeen in small cities, forty in the suburban/rural areas, and four in the rural areas. These represent 5%, 22%, 18% and 10%, respectively, of the total schools in each of these categories. Furthermore, forty-five elementary schools, fifteen middle schools, ten junior/senior high schools, and ten high schools were classified as inefficient by both models. Of these, twenty-eight were located in Buffalo, sixteen in small cities, thirty-one in the suburban/rural areas, and five in the rural areas, representing 46%, 21%, 14% and 13% of the schools in each of these categories.

Conclusions

The information generally available for making school district comparisons has left much of the story untold. Some of the analyses that have been done and published by the mass media may serve a symbolic purpose, but they are of little strategic value in helping people to make beneficial changes in our educational systems. This study has added two dimensions, school district effect and school district efficiency, to the one normally considered, student achievement. In the process, we have highlighted the differences in challenges that school districts face. When more dimensions are considered, it is readily apparent that many school districts, not normally recognized for their effectiveness, are making important contributions to the intellectual development of their students. The contribution of other districts commonly recognized as outstanding are put into perspective. This does not, however, relieve schools and districts that have high school effects but whose students are still failing to meet established achievement standards of the responsibility for bringing those students up to standard; it just further illustrates the magnitude of the task. This study has shown that more spending on education is not the sole means to better results; money has to be spent *wisely* in order to achieve the results desired. This is where the concept of efficiency becomes very important.

To assist in the difficult task of assessing school district fiscal policy, we have developed a series of charts to facilitate the process of benchmarking through making external comparisons. We have also developed a series of achievement charts that enable schools to visualize their actual contribution to student achievement and to make comparisons of student achievement with selected reference groups.

Considerable sophistication has been developed in measuring the equity of resource allocation among and within school districts. As public concern over efficiency of school operations grows, more sophistication needs to be gained in defining and measuring that concept. We hope that this exercise has contributed to the general understanding of the forces contributing to student achievement, to analyzing efficiency of school operations, and to the need for further research on the topic.

Further, if an assessment is made that these statistics and charts are useful to school policy makers and to the general public in better understanding the decisions that have to be made, and in ultimately making better decisions, then judgements need to be made as to whether this type of analysis should be continued on a regular basis and how.

Benchmarking: A Study of School and School District Effect and Efficiency

Context and Purposes

That which cannot be measured cannot be controlled. This understanding is what is driving the standards movement. In the past, it has been common practice for educators to claim success on very little tangible evidence other than the intuitive feeling of those professionals involved in designing and implementing a program. Now higher levels of government–the state in particular and the public in general--are asking, "How do you know? What evidence do you have that supports your perceptions and opinions?"

Accountability has become a principal component of educational reform initiatives in the United States (Ginsberg and Berry, 1998). For decades, financial accountability has been common practice whereby school district records of revenues and expenditures are subjected to external audit and the results are made available as a matter of public record. Since the release of *A Nation at Risk* (National Commission on Excellence in Education) in 1983, the concept of accountability has been extended to include pupil achievement with the establishment of state academic standards, uniform state testing programs, and published results. The two accountability systems are typically maintained and analyzed separately.

Benchmarking is a form of assessment that establishes external standards to which internal processes may be compared. *The New York State School Report Card* provides a vehicle for benchmarking with respect to student achievement. In this study, we have developed additional tools for making external comparisons with respect to achievement and have added tools for assessing fiscal policy and efficiency, i.e., comparing outcomes (achievement) with the amount of resources consumed in the schooling process.

One of the most articulate champions of management (and decision making) by fact was W. Edwards Deming (1986). The Deming principles were originally applied to the management of business organizations, first in Japan and subsequently in the United States. Now they are being applied to the organization and management of schools, school districts, and other educational organizations (Frazier, 1997; Schmoker & Wilson, 1993). Deming contended that collecting and analyzing data on what is most important to an organization is essential for improvement, for validating efforts, and for refining strategies. What is more important to schools, to parents, and to the public in general than student outcomes? Equally important to the taxpayers who pay for the personnel, facilities, equipment and supplies used in developing those outcomes is the assurance that those resources are being applied efficiently and are not being wasted in any way.

The Consortium on Renewing Education (CORE) includes as a major part of its strategy for doubling academic achievement of school children in the United States by the year 2020 the making of comparative analyses across states and local districts. CORE (1998) contends that comparison and competition provide a major "engine" for implementing school reform. "It motivates state and local officials to seek new avenues for improvement. No one, and almost no institution, enjoys unfavorable comparisons" (P. 68).

The first purpose of this research has been to bring together the concepts of financial (inputs) and achievement (outputs) accountability, developing methodological procedures for studying the efficiency of schools and school districts that complement existing studies of effectiveness and fiscal prudence as independent concepts. The second purpose has been to develop a series of benchmarking charts that facilitate the efforts of policy makers at the school and district levels to analyze the effectiveness and efficiency of their operations. These charts assist in the quest of obtaining better results from the resources available by examining trends and making comparisons with reference schools and districts. In pursuit of these purposes, this study has developed:

1. indices of student achievement at the school and district levels that aggregate the results of several outcome measures;
2. indices of school and district effect on achievement that are independent of effects external to the school such as student home influences;
3. indices of resource inputs into the schooling process;
4. indices of school and school district efficiency; and,
5. reporting devices that facilitate the evaluation of school and district policies using the indices developed.

The public school enterprise consumes a lot of money–over $25 billion a year in New York State and over $300 billion nationally, a record amount even when accounting for inflation and student population growth. Despite these record expenditures, many schools and districts are failing to prepare their pupils as fully functioning citizens in today's society. It is commonly thought that the failing districts and schools are failing because they lack the resources that are available to succeeding schools. This is not necessarily so. For over three decades, the relationships between school inputs and outcomes have been carefully studied with the startling conclusion that there is very little evidence showing that such relationships do exist once the family backgrounds of pupils are appropriately accounted for (Hanushek, 1986)[1]

This is not to say that all schools are not using their resources to achieve the greatest effect. During the 1980s there was the Effective Schools Movement that identified specific schools that had an unusually strong academic impact on their pupils (Brookover & Lezotte, 1979; Edmonds, 1979); but, these were "outliers," the exceptions and not the rule. A valiant effort to export their practices to less successful schools met with very limited success.

There are challenges to the conclusions that there is no systematic relationship between school expenditures and student performance (Hedges, Laine, & Greenwald, 1994); but, even the challengers acknowledge that, "the results do not provide detailed information on the most educationally or economically efficient means to allocate existing and new dollars" (Hedges & Greenwald, 1996). All agree that we must develop a better understanding of how resources can be used to greater positive effect in specific circumstances. Hanushek (1996) concludes

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[1] For a full review of this research and its implications see Chapter 13 in Swanson and King (1997).

> The central issue in all policy discussions is usually not whether to spend more or less on school resources but how to get the most out of marginal expenditures. Nobody would advocate zero spending on schooling, as nobody would argue for infinite spending on schooling. The issue is getting productive uses from current and added spending. The existing evidence simply indicates that the typical school system today does not use resources well (at least if promoting student achievement is their purpose). It is tautological to say that we will get good performance if we spend the money wisely. Today the existing knowledge base does not ensure that any added funds will, on average, be spent wisely. That is true even if some schools may spend their funds wisely. (p. 69)

Hanushek (1996), along with many other public analysts, believe that this situation exists because school personnel have had little at stake in improving student outcomes. In the past, there have been few incentives linking rewards to teacher and administrative performance, but the situation is changing rapidly, especially in New York State with the aggressive establishment of high performance standards for students and with the open publication of results through the School Report Cards. Commissioner of Education, Richard P. Mills has been quoted recently (Hendrie, 1999) as saying, "I've told them [local school officials] over and over again that there is a test with one question that they will face this year, and that is, 'What did you get for the money?'"

Tightening the linkages between inputs and student performance is not going to be an easy task, especially when one is not certain what those linkages are. This study is intended to assist school districts in their appraisal of their policies concerning the application of resources to the schooling process and their success in accomplishing higher student achievement. New York State is a good venue for studying such policies because of the ready availability of pupil achievement information and Western New York, in particular, is a good place because of the ready availability of financial information in a user friendly format (Erie No. One Board of Cooperative Educational Services, annually).

New York State is unique among states in that it has offered continuously state criterion referenced examinations for over a century, the New York State Regents Examinations. In the early days, successful completion of these examinations resulted in the awarding of state issued certificates and diplomas that provided a common basis to employers and colleges for assessing achievement of students completing their primary and secondary education. At that time, many children received their primary education in thousands of poorly supervised one room schoolhouses and their secondary education in hundreds of very small high schools that varied greatly in quality. As school districts throughout the country became better organized and staffed with better trained teachers, other states eliminated state developed examinations and the issuing of state diplomas. New York State, alone, continued to offer the Regents examinations and diplomas for high school subjects, although the primary completion examinations and certificates were dropped with the raising of the compulsory attendance age to sixteen.

In 1966 the New York State Education Department initiated the Pupil Evaluation Project (PEP) that led to the development of a series of examinations assessing achievement in the elementary and middle grades. These examinations were intended to measure the accomplishments of schools and districts, not individual students. Reports were made available to schools, school districts and researchers, but not to the general public until 1987.

Chapter 655 of the New York State Laws of 1987 required the Board of Regents and the State Education Department to submit an annual report to the Governor and the Legislature concerning, among other things, student achievement (as measured by the PEP tests and Regents examinations), student and teacher characteristics, and financial information. Data are reported by district, district type, ethnic group, etc. The report, New York: The State of Learning, is due January first of each year and usually becomes available to the public sometime in February. The report released in February of 1995 also published for the first time 1990 decennial census data for school districts which are useful in statistically controlling for variations among school districts in socio-economic characteristics that influence student achievement. These reports are available to the general public, but few avail themselves of them, although some enterprising newspaper reporters do massage the data into articles with eye-catching headlines.

In 1996, the State Education Department issued the first *School Report Cards*. These report cards focus on academic achievement, although they also give information on attendance, suspensions, school organization, pupil demographics and, district total and approved operating expenditures per pupil. Average achievement is reported for the school, district, schools with similar demographic characteristics, and all public schools in the state. For the first time, a concerted effort was made to assure that the information was made available to the general public by requiring school districts to develop a school report card, share it with newspapers, attach it to the school budget, and make it publicly available. The State Education Department publicly releases its information on each school and district and makes it available on the Department's World Wide Web site.

Following the national trend, the New York State Board of Regents authorized in April 1994 the development of academic standards in English language arts, mathematics, science, and social studies for children and youth enrolled in elementary and secondary schools and instruments for assessing the achievement of those standards. While much attention has been directed toward the upgrading of high school Regents examinations, the state tests for elementary and middle school children are being revised to reflect the new learning standards and to align them with the high school examinations.

The situation is dynamic. New examinations are being developed and phased in through the year 2001. Additional information about the performance of students with disabilities and limited English proficiency students is now being published. New reporting procedures have been developed whereby, beginning with the 1998-99 school year, assessment results by individual student (rather than school and district aggregates) will be transmitted electronically to the State Education Department in Albany using an enhanced version of the Local Education Agency Program (LEAP) reporting system previously used by schools receiving Title I and other special funding. These changes will enable policy analyses of much greater detail and sophistication than is now possible.

While this study used data available for the school years 1993-94 through 1995-96, the procedures and reporting devices can be adapted and updated as new information becomes available. Achievement data were obtained from the 1997 *New York State School Report Card* data base. Financial data for the 1995-96 school year were derived from *Financing Our Schools-1997*, prepared by the Erie County No. One Board of Cooperative Educational Services. The cases were limited to the 101 school districts and their schools in the western region of the state containing the two county Buffalo metropolitan area and six rural counties, three of whom contain small cities. The region is geographically about the size of the state of Connecticut and contains approximately 1.5 million people.

Two types of outcome measures were developed: average student achievement and average school and district effect. Average student achievement is measured by four factor scores at the district level and six average scores at the school level. Both sets of scores combine results of state examinations in reading, writing, mathematics, science and social studies given in grades 3, 4, 5, 6 and 8 and for fifteen Regents examinations given in high school. School district effect is estimated through a multiple regression procedure that statistically removes co-variation of family and environmental characteristics from the student achievement scores. Input measures consist of expenditures (adjusted for within region variations in teacher costs) per pupil units (adjusted for variation in pupil characteristics) and pupil staff ratios. School district efficiency is measured using a linear programming technique known as data envelopment analysis (DEA), a modified quadriform approach, and a ratio approach. School efficiency is measured using the DEA and ratio approaches. The quadriform approach is not used in measuring school efficiency since financial data are not available at that level. The availability of data on staff personnel per pupil enabled the other two approaches to measuring efficiency.

Explanation of how aggregate student outcome measures were developed is presented first followed by discussions of the schooling input and efficiency measures. The fourth section of this report presents a series of benchmarking type charts that sharpen the ability of policy makers to evaluate the performance and fiscal policies of their districts and schools in comparison with the other districts and schools in the region.

School and District Output Measures

Average Aggregate Student Achievement

Pupil achievement is popularly considered to be an indicator of how well students are equipped for entrance into institutions of higher learning and into employment. New York State reports annually the average results at various levels of proficiency by school and by district for tests given in grades three through twelve. Because of the large number of scores reported, it is difficult to get a general sense of how well a school or district is doing without further analysis.

To construct global measures of student achievement at the district level, we subjected the results of the test batteries to a statistical procedure known as factor analysis and generated four factor scores reflecting achievement at grade 3, grades 4 and 5, grade 6, and high school. The third grade achievement factor consists of the percent of students scoring above each of four state reference points on examinations in reading, and scoring above the state's minimum reference point in mathematics--all weighted to maximize the total variance explained. The fourth/fifth grade achievement factor consists of the average score on the fourth grade science test and the percent scoring above the state minimum reference point on the fifth grade writing test. The sixth grade achievement factor consists of average scores similar to those for third grade plus the average score on a social studies test. The high school achievement factor consists of percent of enrollment for an appropriate grade cohort passing and the percent achieving mastery on Regents examinations in fifteen subject areas--each weighted to maximize the total variance explained.

It was not possible to do a factor analysis at the school level because the great variation in grade configurations among buildings would result in a missing data problem that would eliminate most schools from the analysis. Instead, we computed an average of the standardizes scores of tests for each elementary grade in which tests were given. Three averages were developed for each high school, percent passing and percent achieving mastery on Regents examinations and per cent passing the occupational education Regents.

Standard Score Charts

There are many bases for making comparisons, each having its advantages and disadvantages. Comparing ranks within a group of schools or districts is one approach. A basic difficulty with ranks is that the differences in the raw scores of measured attributes between ranks at the extremes are likely to be large when compared to those at the center of a distribution, i. e., there may be little difference of consequence from a policy perspective between ranks of 40 and 60 in a distribution of a hundred cases whereas the difference between ranks of 10 and 1 may be considerable. The problem is reduced only marginally when percentiles, deciles or quartiles are used. These statistics also have the additional disadvantage that they cannot be added, subtracted or averaged. Also, because of the unequal intervals, these statistics are not very useful when comparisons are made among a number of attributes.

To facilitate comparisons on a given attribute (e.g., high school achievement), and across attributes, we have converted the "raw" scores of each distribution to a common metric with the mean equal to zero (0) and the standard deviation equal to one (1) under the assumption that each attribute approximates a distribution bounded by a "normal curve." The conversion results in what is called a *standard score*. Standard scores have an equal interval scale (one standard deviation) and can be aggregated and averaged.

A normal curve is a symmetrical, bell shaped curve as illustrated in Figure 1. Its importance stems from the fact that chance events in large numbers tend to distribute themselves within the boundaries of the curve. For this reason, it has been of great interest to mathematicians and astronomers for over two centuries and to statisticians for most of this century. The mean of the distribution bisects the curve with half of the cases (and area) being to its left and half to its right. A standard deviation can be conceived as a length along the base line of the curve from the mean out to the right or to the left to the point where the curve inflects. In a normal distribution, approximately two-thirds of the cases fall between one standard deviation above the mean and one standard deviation below the mean (i. e., between standard scores of +1 and -1). Ninety-five per cent of all cases will be within two standard deviations of the mean or between standard scores of +2 and -2.

Figures 2 and 3, respectively, show the standard score charts for district and school achievement measures described in the previous section. The normal distribution scale is shown on the left of each chart. There is a vertical bar for each score reported with a designation for each standard deviation above or below the mean. The highest marking on a bar represents the highest score in the distribution; the lowest marking represents the lowest score in the distribution. The area between one standard deviation above the mean (+1) and one standard deviation below the mean (-1) has been shaded. Two-thirds of all cases (districts or schools) will have scores in this range and variation within this range is not highly significant for policy evaluation purposes. Schools or districts scoring above or below the shaded areas are outliers. No distribution matches the normal distribution perfectly; some are skewed above the mean and some are skewed below the mean.

Average Aggregate School and District Effect

School and school district effectiveness is frequently judged erroneously on the basis of unadjusted student achievement. At least thirty years of research into the matter strongly suggest otherwise. Research studies that explain differences in student achievement have shown it to be a function of many forces. The unique influence of formal schooling is relatively small in comparison with other forces such as education level of parents, family environment, and peer group interaction[2]. The New York State Education Department (1997) has identified four indicators associated with poor school performance: minority racial/ethnic group identity, living in a poverty household, having a poorly educated mother, and having a non-English background.

The findings of a recent study by the RAND Corp. (Grissmer, Kirby, Berends, and Williamson, 1994) is consistent with earlier findings. The RAND study identified the most important family characteristic influencing student performance in school as parents' education. Income, family size, and mother's age at child's birth were modestly significant. Whether the mother worked or not had a negligible effect after accounting for other family factors. Single-parent status by itself was not significant although single-parenthood is highly correlated with other factors that have negative effects on achievement such as low family income. The presence

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[2] An abbreviated list of citations include: Coleman, 1966; Mayeski, et al., 1972; Summers & Wolfe, 1975; Bridge, Judd, & Moock, 1979; Rutter, Maughan, Mortimore, & Ouston, 1979; Dreeben & Thomas, 1980; Madaus, Airasian, & Kellaghan, 1980; Hanushek, 1986, 1991; Ferguson, 1991; Hedges, Laine, & Greenwald, 1994; Sandowski, 1995.

Figure 1. A Normal Distribution Bounded by A *Normal* or *Bell-Shaped* Curve

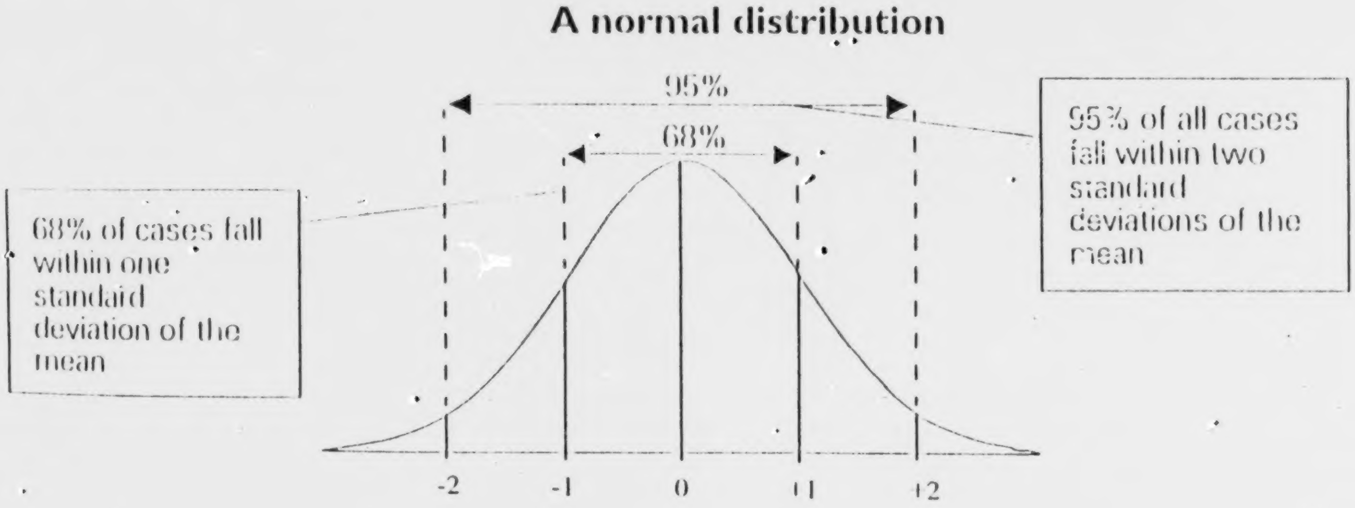


Figure 2. Achievement Chart XVII: Aggregated Student Achievement and School Effect for Grades 3, 4/5, 6 and Regents Examinations for Districts (in standard scores)

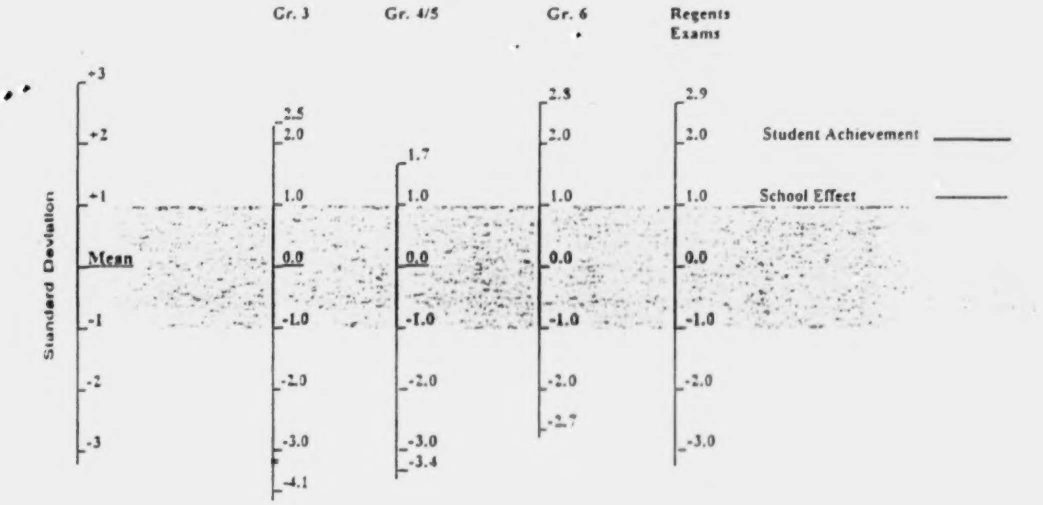
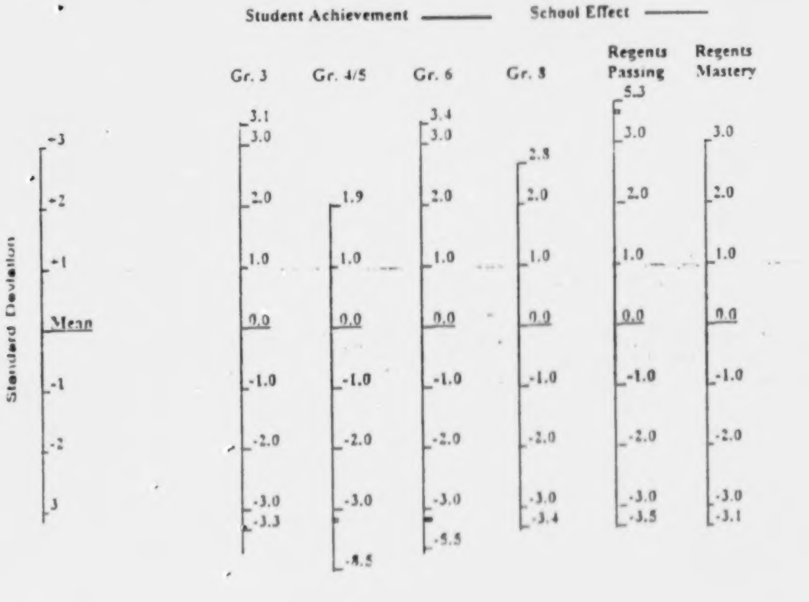


Figure 3. Achievement Chart XVI: Aggregated Student Achievement and School Effect for Grades 3, 4/5, 6, 8 and Regents Examinations for Schools (in standard scores)



of these factors affecting student achievement differ markedly among school and district populations, meaning that the work of some schools and school districts is assisted by favorable environmental factors and is frustrated by unfavorable environmental factors in others. The pernicious effects of poverty are compounded when poor students are highly concentrated (Kennedy, Jung & Orland, 1990; Abt Associates, 1993; Pelavin Associates, 1990).

In total, school takes up only about 13 percent of the waking hours of a person's first 18 years of life (Walberg, 1984). Children receive their initial instruction (particularly in language arts) in the home and in the community, albeit informally, and those children whose parents are well-educated usually come to school better prepared to function more efficiently in an environment that emphasizes abstract concepts than do children whose parents are less well educated. Schools composed of children who already have developed good learning and language skills can begin instruction at a more advanced level than can schools where most of the children enter with poor skills. The problem of poor entry level skills for many American schools is recognized by the first of the eight national goals for public education set by Congress in 1994 with the Educate America Act: *By the year 2000, all children in America will start school ready to learn.* Throughout the schooling process, the work of the school is re-enforced for children living in language rich home environments, but not for other children, causing the achievement gap between the two groups to widen. The differences in population characteristics among schools and districts mean that some schools and districts must meet their instructional responsibilities in quite different ways than others do.

Research in the United States on the impact of family socio-economic status (most importantly, education and income) on the achievement of children has been clouded by the issue of racial and ethnic group membership. Despite the ethnic focus, low socio-economic status has emerged as the dominating detracting factor from achievement with little, if any, effect being explained independently by minority group membership. This is not to deny that racial and cultural minority children experience discriminatory situations which have an additional negative impact on the development of self-concept and realistic aspirations and expectations. Some social scientists refer to the treatment of racial and cultural minorities in the United States as functioning more like a caste system than socio-economic differentiation (Ogbu, 1978; Brown, 1990).

Socio-economic characteristics are only proxies for interactions within families and society which tend to be related to socio-economic status. Home environment indicators predict academic learning twice as well as socio-economic status of families (Walberg, 1984), but they are much more difficult to measure for research purposes–especially on a large scale–and data on home environments are not readily available. Correlational and status studies are useful in pointing out the overall impact of socio-economic status on pupil achievement, but they do little to advance our understanding of how the effect is transmitted or what educators can do to intervene.

The inter-relationships between environment and student achievement are too complex to be explained through the lens of a single discipline. Four main perspectives characterize the literature on school performance of children from lower SES families and racial and cultural minorities: the cultural continuity/discontinuity approach, the secondary cultural continuity approach, cultural reproduction theory, and the culture and cognition approach (Emihovich, 1994). Poor academic achievement by such children is attributed in these theories to a variety of factors including:

- differences between home and school in interactional, linguistic, and cognitive styles;
- effects of macroeconomic and social conditions, especially labor market forces and minority groups' beliefs about their access to employment and other social benefits;
- family values concerning the importance of education, adherence to prevailing social norms, and allegiance to community welfare rather than individual gain;
- the school's perceived role in reproducing the social order to maintain class and racial barriers to social mobility;
- student resistance to learning behaviors expected by school authorities which would bestow upon the students identities which are stigmatized among their peers; and,
- individual variations in performance as a function of culturally influenced cognitive capacities.

Several of the above perspectives have been unified through the concept of multiple literacies.

> [E]ach literacy is embedded within particular culturally organized settings, shaped by children's early experiences in the home and community environments, and influenced or modified by alternative literacies children encounter daily in schools and other social settings. In short, for children to be successful in school and society, they need to master a broad range of literacy competencies, almost in the sense of being multilingual, to cope with the diversity they can expect to encounter in written and oral formats across a wide array of situations. (Emihovich, 1994, p.1231)

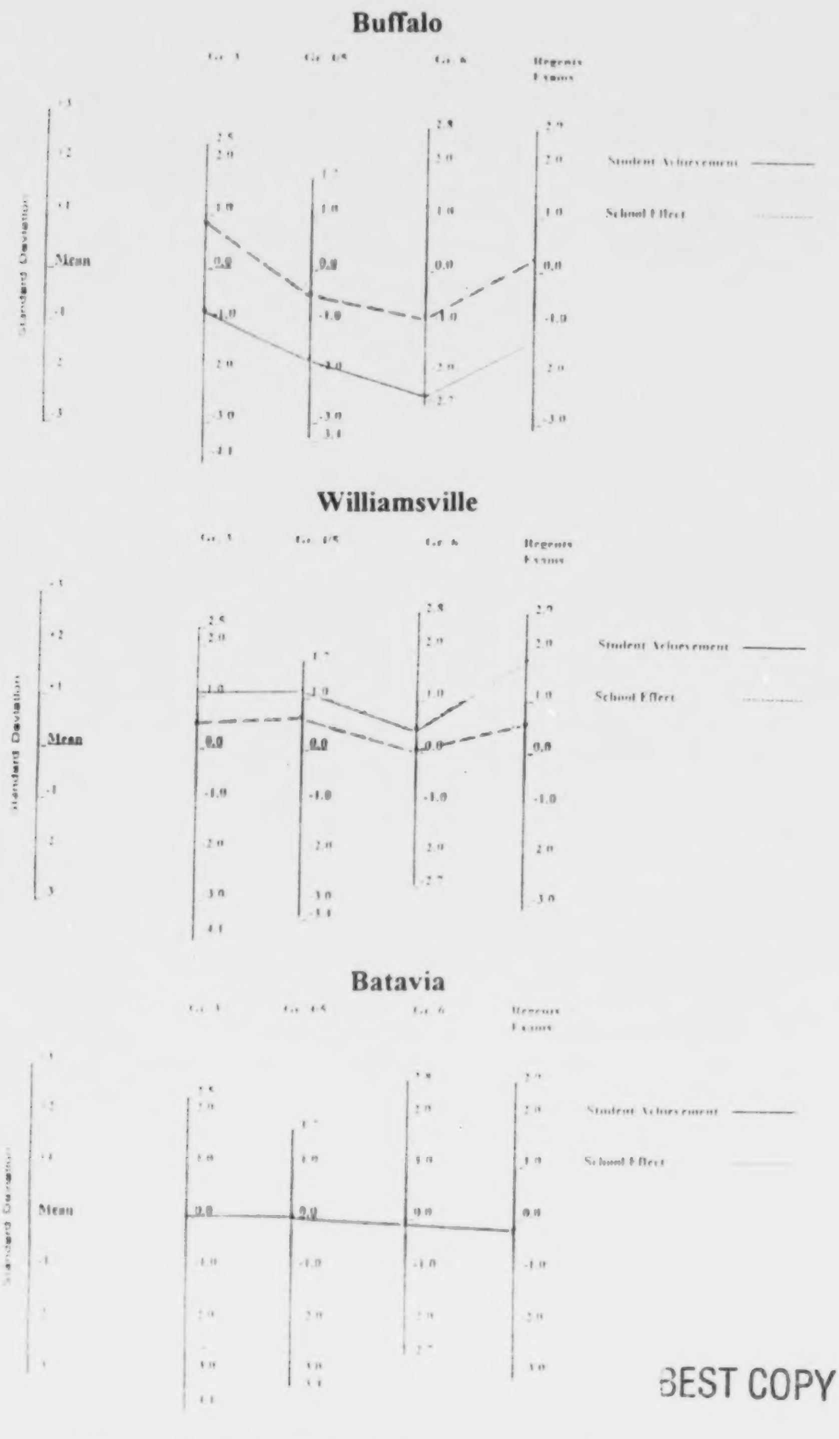
Research clearly shows that language and cultural differences in students' lives are interwoven with economic and social conditions that facilitate or impede knowledge acquisition. This bonded relationship must be taken into account in designing instructional strategies for children. It must also be factored into any assessment of school and district performance.

To estimate the effect of school districts on student achievement, we have used residual scores derived from multiple-regression analysis with the measures of student achievement previously described serving as dependent variables and family, school and district characteristics serving as independent variables. The district analysis used a census poverty index, combined wealth index (a measure used in calculating New York State aid to school districts consisting of an average of the ratios of per pupil property value and personal income to the state averages of those statistics), percent of children qualifying for free lunch, percent children with limited English proficiency, and district classification (e. g., urban, suburban, rural) as control variables. For the school level analysis, percent of children qualifying for free lunch, percent children with limited English proficiency, and district classification served as control variables.

The residual scores partial out the wealth effect from the student achievement scores producing what we call a measure of *school effect*. The nature of the correction at the school district level is shown in Figure 4 using the standard score chart shown in Figure 2. Figure 4 shows the school district effect adjustment (dash line) and unadjusted student achievement (solid line) for three school districts in the region. Buffalo is a large central city school district with a sizeable proportion of its population in poverty; thus, the school effect scores indicate a greater school effect than student achievement scores alone would suggest. Williamsville is an affluent suburban district; statistically controlling for the effects of socio-economic status of the district on student achievement makes the school effect scores less than student achievement scores alone would suggest. Batavia is a small city school district of average socio-economic characteristics for the sample; because of its average demographic characteristics, the school effect scores are virtually identical to the student achievement scores. Interpretation of standard score profile charts is discussed in the "Policy Analysis Tools" section of this report.

The nature of the correction at the school level is shown in Figure 5 using the standard score chart shown in Figure 3. The school effect adjustment (dash line) and unadjusted student achievement (solid line) are shown for four schools in the Buffalo City School District. City Honors is a magnet secondary school (grades 5-12) that screens applicants using an entrance examination. As a result, its student achievement is high (the highest in the region) and the socio-economic status of its students is relatively high for the region and very high for the city school district; this yields a school effect that is generally lower than the school's unadjusted student achievement–especially on the Regents examinations. Grover Cleveland is a neighborhood high school serving a mostly poor population, many of whom are non-English speaking. Its student achievement scores are nearly two standard deviations below the mean of the sample for passing and mastering the Regents examinations; but, its school effect scores are slightly above the sample mean. Although the Futures Academy is a magnet school serving grades K-8, its pupil characteristics are similar to those for the district as a whole; its student achievement is near average for the sample and its school effect is largely above average. Hamlin Park elementary school is a low achieving neighborhood school serving a generally poor population; adjusting the student achievement scores for socio-economic factors moves the school effect scores only slightly higher. The higher student achievement scores for Futures Academy than for Hamlin Park may reflect family characteristics and attitudes not measured but made operational through the district's magnet school choice policy (Adler, Petch, & Tweedie, 1989; Witte, 1993, Martinez, Thomas, & Kemerer, 1994). Or, the differences may reflect more effective instructional or other strategies at the Academy.

Figure 4 Achievement Chart XVII: Aggregated Student Achievement and School Effect for Grades 3, 4/5, 6 and Regents Examinations for Districts (in standard scores) for Three School Districts



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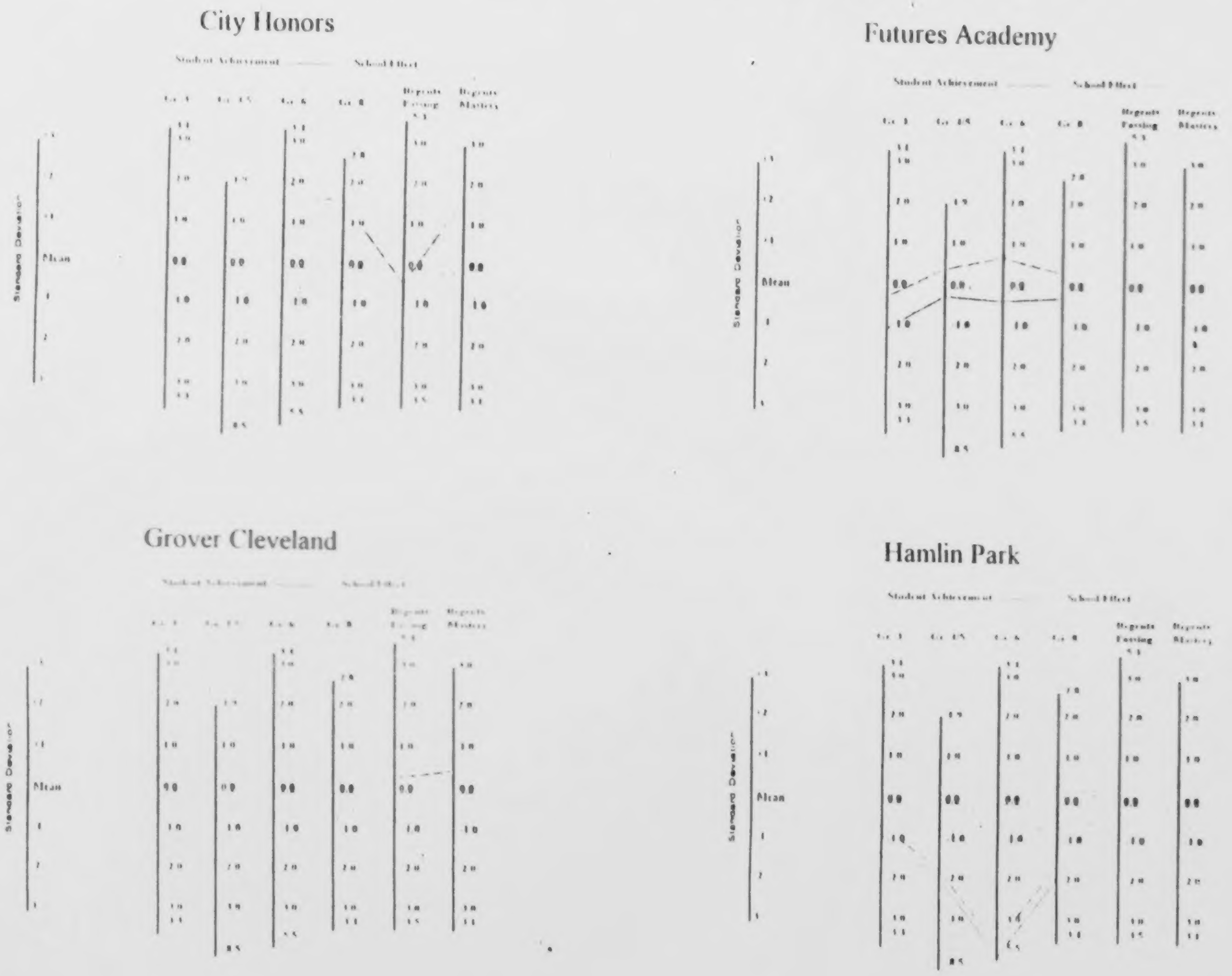
[1] Note: School effect scores are almost identical with student achievement scores.

Figure 5. Achievement Chart XVI: Aggregated Student Achievement and School Effect for Grades 3, 4/5, 6, 8 and Regents Examinations for Schools (in standard scores) for Four Buffalo Public Schools



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School and District Input Measures

Two types of inputs into the schooling process were used, numbers of personnel (teachers, other professionals, and para-professionals) and financial. Both inputs were adjusted for differences in sizes of schools and districts and the characteristics of their pupils by dividing by a measure of pupil educational need (i.e., teachers per 100 educational need unit or dollars per need unit). The financial measures in the efficiency analysis were also subjected to a correction for variations in the cost of teachers. The nature of these corrections is described below.

Measuring Pupils' Educational Need

The scope of the aggregate pupil educational need of a school or district is crudely expressed in terms of the number of students served. This measure is closely tied to the size of the teaching force, the sizes of programs and facilities, and ultimately, to the amount of money required. But resource requirements are not uniform among all pupils; some receive services that others do not. In an earlier section, we pointed out that how resource utilization is linked to student achievement is not known; never-the-less, state policy prescribes specific programs for pupils with certain characteristics, and sometimes sets staffing standards for those programs. Examples of this would be programs for pupils classified with some sort of disability and programs for the gifted and talented. Also, state policy recognizes common practice. For example, in several state aid formulas, a secondary pupil is treated as 1.25 elementary pupils because most school districts spend about 25 per cent more per pupil on their secondary school programs than they do on their elementary school programs. Ironically, there is considerable research suggesting that higher expenditures at the elementary level are more effective in terms of their impact on student achievement (e.g., Hitzges, 1988; Wenglinsky, 1998).

The net effect of these state policies is to make the operations for some schools and districts more expensive than for others depending on the characteristics of the pupils served. Descriptions of per pupil expenditures that do not account for differences among program costs substantially overstates the resources reaching non-classified students (Lankford & Wyckoff, 1999), making districts with high proportions of classified pupils appear unduly inefficient (Reschovsky & Imazeki, 1998; Parrish & Hikido, 1998). To compensate for these differences, we divided resource inputs by a measure of pupil educational need that reflects state aid policy. We began with the Total Aidable Pupil Unit (TAPU) used in several state aid formulas. TAPU is calculated by applying the following weightings to the average daily attendance of pupils with specified characteristics:

½ day Kindergarten (K)	.50
Full day attendance, grades K-6	1.00
Grades K-6 Pupils with Special Educational Needs (PSEN)[3]	1.25
Full day attendance equivalent, grades 7-12	1.25

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[3] PSEN reflects the proportion of pupils achieving below the State reference point on the PEP achievement tests administered in 1984-85 and 1985-86.

Grades 7-12 PSEN	1.50
Summer School	.12

The above weightings do not reflect the additional costs of program accommodations for pupils designated to receive special educational services. To estimate the impact of these costs, .8 times the number of pupils so classified was added to the total TAPU. This weighting was based on an analysis of the ratio of costs of educational programs for the classified disabled compared to regular programs in Western New York (1.8). The resulting statistics are referred to subsequently as pupil need or EDNEED.

Teacher Cost Index (TCI)

There is a growing recognition of the importance of adjusting for cost variations among localities in making comparative studies of school costs (Chambers, 1996; Duncombe & Yinger, 1998; Parrish & Hikido, 1998; Reschovsky & Imazeki, 1998; Taylor, 1998). While we were aware of these studies at the beginning of this analysis, we did not believe that cost adjustments would be necessary within this relatively homogeneous economic region. As the analysis progressed, however, we discovered that a strong efficiency bias was developing against the school districts in the two county Buffalo metropolitan area due to their higher teacher costs. Subsequently, we did make cost adjustments for the efficiency analysis portions of this study and the reasonableness of the results improved. Cost adjustments were not made in the development of the financial standard score charts to be described in the “Policy Analysis Tools” section.

We used Chambers' and Fowler's (1995) *Teacher Cost Index (TCI)* for our corrections. The index is based on the fact that approximately 80 per cent of educational costs are for personnel and that teachers account for most of this; further, the assumption is made that variations in other personnel costs will reflect variation in teacher costs. The TCI simulates the variations in teacher salaries resulting from only those factors affecting the supply of comparable teachers across geographic locations. Stated another way, the TCI is intended to measure variations in the price of teachers (and by implication, other personnel) which are beyond the control of local decision makers.

While indices are available at the district level, we calculated an average adjustment for all districts in a county under the assumption that within county variations were more likely to be a function of school district policy (and thus a possible contributor to efficiency/inefficiency) than a function of structural factors beyond the control of the district. The adjustments by county are as follows:

County	Adjustment
Allegany	.9152
Cattaraugus	.9253
Chautauqua	.9622
Erie	1.0740

Genessee	.9437
Niagara	1.0110
Orleans	1.0276
Wyoming	.9527

According to these indices, Erie County school districts face the highest costs, 7.4 per cent above the national average, and 15.9 per cent above the lowest cost county in the sample, Allegany.

There is some evidence that the adjustment may be too small for the Buffalo City School District. In a study of New York State school districts, Duncombe and Yinger (1998) found considerable variation in costs per pupil required to achieve a given performance level. With 1.0000 representing the state average cost, the index for Buffalo, Rochester, and Syracuse was 1.7550 meaning that, for the three districts to achieve a given performance level, 75.5 per cent more cost would be incurred than for the average New York State district. Their indices for upstate rural areas were .9780, small cities 1.0650, and suburbs .9090. They found the most important factors influencing educational costs were: teachers salaries, enrollment, per cent of children in poverty, per cent female-headed households, per cent children with severe handicaps, per cent of students with limited English proficiency, and population density. The Duncombe and Yinger cost corrections represent a combination of the TCI adjustment and the pupil educational need adjustment discussed in the previous section and are, therefore, not directly comparable to the TCI correction. Chambers (1996) found that, nationally, urban area school costs ran about 15 per cent above those incurred in rural areas.

School and District Efficiency

Efficiency is the ratio of outputs to inputs. Efficiency is increased by increasing the probability of realizing targeted outcomes secured from available resources or by maintaining a given level of outcomes while using fewer resources. In the education lexicon, efficiency concerns are expressed in terms of *accountability* and *standards*.

While equity in the allocation of educational resources was a primary concern of policy makers in the 1960s and 1970s, the impact of a global economy has brought efficiency to the forefront in both the public and private sectors. Now they seek schools that are equitable and efficient. Over the years, policy analysts have gained a considerable amount of sophistication in analyzing public policy and performance for equity but are only beginning a quest for operational definitions and analytical techniques that will permit the study of efficiency in educational operations (Anderson, 1996).

Most educators do not commonly use the concept of *efficiency* in analyzing resource allocation problems. As a result, they are being criticized currently for taking schooling inputs (pupils, teachers, buildings, classrooms, teaching supplies and equipment, heat, light, etc.) pretty much for granted–almost as a civil right of students and the profession. In assessing the shortcomings of the schools, educators tend to examine only curricular matters (technical efficiency) and not the costs associated with possible alternative solutions (economic efficiency).

This leads to a practice of "adding on" new programs to an existing set of programs rather than considering the restructuring of the entire educational enterprise. This conservative approach has made the educational system highly fragmented, very labor intensive and, in the view of some, overly expensive.

Schools are institutions functioning largely in the public sector. They therefore do not face the stringent discipline for efficient operations imposed by the market on institutions operating in the private sector (Benson, 1978; Guthrie et al., 1988). Governments in capitalistic countries tend to deal with issues in which economic concerns are not overriding. As government activities have grown to consume over 40% of the gross national product, however, the public is forcing government officials–including school officials--to become more cognizant of the concept of *economic efficiency*.

Hanushek (1986, p. 1166) defined economic *efficiency* as "the correct share of input mix given the prices of inputs and the production function." *Production function* is defined as the causal relationship between inputs and outcomes; thus it is what goes on in schools and classrooms that directly affects the minds of students as measured by tests and other outcome measures. There is a distinction between *economic efficiency* and *technical efficiency*. The latter considers only the process of combining inputs to produce outcomes; as noted above, this is the usual focus of professional educators. Technical efficiency does not take into account the cost of inputs as does economic efficiency. Both types of efficiency are important in evaluating educational policy.

Organizations can achieve efficiency in many ways. In order to be relatively efficient, a decision making unit (e. g., schools or districts) may have higher output levels than other units with the same level of inputs; it may even have output levels below average provided that the input levels are considerably lower than those of other decision making units. In education, we are not only concerned with the efficiency measure, but also with district effectiveness, that is, how well the district has met its educational objectives. While some minimum level of effectiveness should be an integral part of efficiency, it is possible for effective organizations to be inefficient by using an excessive amount of resources relative to other equally effective organizations. Furthermore, efficient organizations may be only moderately effective. In considering the relationship between efficiency and effectiveness, a number of possibilities arise.

Efficient Districts

Dealing first with efficient districts, the following scenarios are possible.

- First, there are the efficient districts which are characterized by above average performance in terms of outputs. Such districts could be considered "star" performers and could serve as models for other districts attempting to improve their performance. Such districts may span the expenditure range, indicating that high expenditures and high efficiency are not mutually exclusive. While most districts strive to be "star" performers, not all efficient districts fall into this category.

- There are also efficient districts whose performance is below average, but since their expenditures are relatively lower, they are rated as efficient. These districts seem to be quite effective at controlling costs. The operational emphasis for these districts should be on improving performance, even if costs were to increase. For such districts, there may also be concerns regarding the adequacy of resources. Their performance is usually relatively good given the resources available; however, these districts may not have adequate resources to enable them to improve performance. Given the efficiency of these districts, it would be worthwhile to determine whether additional resources could be generated in order to improve student achievement. On the other hand, these districts may be able to purchase adequate educational resources due to favorable cost factors in the district; this seems to be especially likely for many rural school districts.

Inefficient Districts

With respect to districts evaluated as relatively inefficient we have: a) districts whose performance is above average, but, whose expenditures are very high compared with other districts; b) districts that are performing poorly and that have high expenditures; and c) districts that are performing very poorly and that have below average expenditures but these expenditures are high in relation to their performance indicators. The inefficiency of the districts in these categories may be due to a number of reasons including:

- poor cost control;
- administrators and/or teachers who are less skilled than in other districts;
- significant cost factors beyond the district's control;
- the purchase of resources providing outputs/outcomes which are not being measured;
- economically disadvantaged children who require higher expenditures in order to attain acceptable performance.

Examples of expenditures that may not necessarily result in additional *measured* outputs/outcomes include those to provide a more aesthetic environment, for enhanced arts or athletic programs, an enriched curriculum, etc. While such expenditures may not necessarily increase the measured outputs, they are often expected and supported by taxpayers, particularly in wealthy suburban districts. The Amherst and Williamsville school districts may be examples of this situation.

Districts that find themselves with economically disadvantaged children who require higher expenditures to provide compensatory educational services may receive additional funding to deal with disadvantaged children; however, the amounts received may be insufficient to provide all of the services required to compensate for their disadvantages. Reschovsky and Imazeki (1998), for example, found the appropriate correction to be 159 percent. Buffalo, Niagara Falls, and other core cities in the sample may be examples of this situation. Our analysis takes this phenomenon into account through the use of the EDNEED measure described above.

Another example of a cost factor beyond a district's control is teacher experience. The single salary schedule awards teachers for each additional year of experience (up to a designated maximum); but, there is little evidence that experienced teachers are linked to higher student academic achievement. Several of the districts in the region, especially first ring suburbs, have experienced dramatic declines in enrollments–some losing more than half of their peak pupil enrollments. This caused them to lay off many teachers during the 1970s and early 1980s (beginning with the least experienced because of union agreements and state law). As a result, these districts now have very senior (and expensive) staffs and tend to be identified as economically inefficient. The Kenmore and Maryvale school districts may be examples of this situation. In contrast, districts that are growing and adding new faculty have relatively low salary costs and are often identified as economically efficient. These districts tend to be second ring, and sometimes affluent, suburbs; Orchard Park and Clarence may be examples of this situation. In a few years, as the second ring suburban staffs mature, staffing costs will increase significantly for them while costs in the first ring will decline as their older staff members retire and are replaced by younger and less expensive ones. It is possible that the economic efficiency classification of both types of districts can change with no change in operations or effectiveness. The technical efficiency of the districts would not be affected by this phenomenon.

Another example of cost differences that are not fully under the control of school districts is labor costs. Even within the eight county Western New York region, there are substantial differences in the going rate for teachers and support personnel, especially between the two county Buffalo SMSA and the six rural counties. We attempted to control for these differences in our economic efficiency analyses by adjusting expenditures by the *Teacher Cost Index* (TCI) (Chambers & Fowler, 1995) as explained in a previous section.

School District Efficiency

Modified Quadriform Analysis. The quadriform type of analysis was initiated by Hickrod et al. (1989) and slightly modified by Anderson (1996). In this type of analysis, an adjustment for unalterable school characteristics, mostly related to socio-economic status, is made for both student achievement and expenditure. The adjustment for student achievement was similar to our school effect measure. We do not believe that a socio-economic adjustment for expenditure is appropriate because much of the higher expenditures of affluent districts can be attributed to the purchase of lifestyle accouterments beyond that needed to provide for basic educational programs of quality (Bigenwald, 1977). We did, however, adjust expenditures for variation within the region for the cost of teachers using the TCI index. We also adjusted expenditures for variation in pupil characteristics among districts related to program differentiation by using the EDNEED measure as previously described instead of unadjusted enrollment.

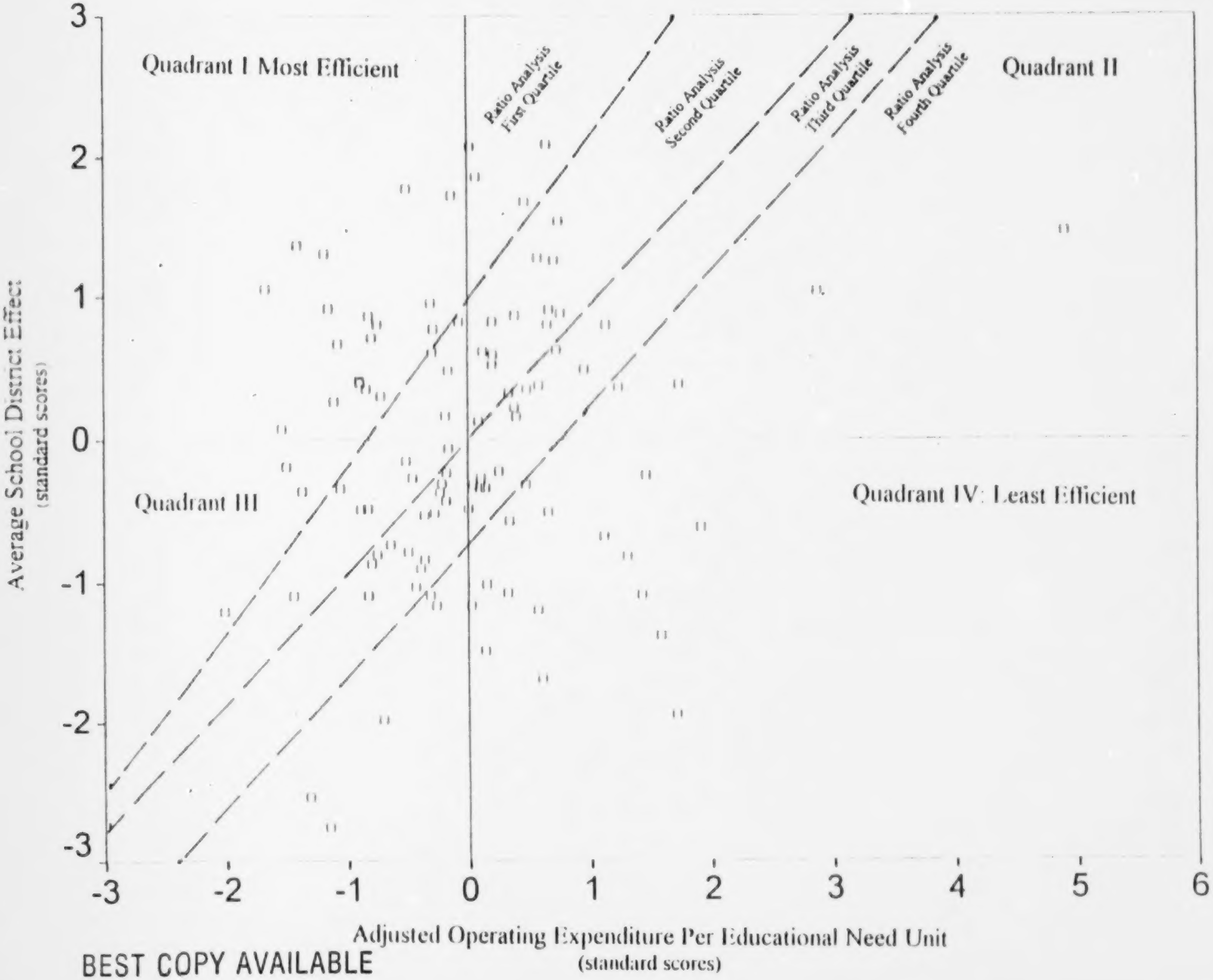
The first level of analysis was merely to plot the 101 districts in the region according to average district school effect (Y or vertical axis) and approved operating expenditure per EDNEED (X or horizontal axis) using standard scores for each measure. The measure of school effect was determined by averaging the standard scores of the four district level measures of school effect (grade 3, grades 4 and 5, grade 6, and high school). The resulting distribution of the districts is shown in Figure 6. All of the districts above the horizontal (X) axis are above average in school effect and all of the districts below the horizontal axis are below average in school effect. All of the districts to the left of the vertical (Y) axis are below average in expenditure per pupil; all of the districts to the right of the vertical axis are above average in expenditure per pupil. The intersection of the two axes represents being average on both expenditure and school effect measures. This modified quadriform analysis is a measure of economic efficiency.

Districts in Quadrant I (upper left) are above average in school effect and below average in expenditure; school districts in this quadrant are the most efficient in the region according to this analysis. All but six of the districts in this quadrant are from outside the Buffalo metropolitan area (Erie and Niagara Counties), a slight under representation from the expected. Quadrant II (upper right) represents districts that are above average in school effect and are also above average in expenditures; there is a slight over representation of the high achieving, high expenditure metropolitan suburban districts in this quadrant. Quadrant III (lower left) represents districts that are below average in school effect and in expenditure. Quadrant IV represents districts that have a below average school effect and are high spending; these districts are the least efficient in the region according to this analysis.

As with most studies of relationships between student outcomes and expenditures (see discussion in the "Context and Purposes" section at the beginning of this report), there was no statistically significant correlation between school district effect and expenditure (r = .15; level of significance, .15). School districts with a school district effect on student achievement more than one standard deviation above the mean (the top 17 per cent of the districts) ranged in expenditure from $3,849 per pupil unit (Panama) to $7,987 (Chautauqua before merger with Mayville), both in Chautauqua County. School districts with a school district effect on student achievement more than one standard deviation below the mean (the lowest 17 per cent of the districts) ranged in expenditure from $3,631 per pupil unit (Falconer) to $5,892 (Maryvale). The difference in expenditure per pupil unit between Falconer and Panama (both in Chautauqua County) is less than $200, yet Panama's district effect on student achievement is more than two standard deviations higher than Falconer's.

Looking at school effect from the standpoint of expenditures, school districts spending more than one standard deviation below the mean range in effect from 1.36 standard deviations above the mean for Akron in Erie County to 2.76 and 2.55 standard deviations below the mean for the Kendall and Albion school districts in Orleans County. The one district spending more than two standard deviations below the mean (Falconer) had a school effect more than one standard deviation below the mean. Districts spending more than one standard deviation above the mean range in effectiveness from 1.94 standard deviations below the mean for Niagara Falls to 1.46 above the mean for Chautauqua (before its merger with Mayville). The two school districts spending more than two standard deviations above the mean (Chautauqua and Barker in Niagara

Figure 6 Bivariate Distribution of Average School District Effect and Adjusted Operating Expenditure per Educational Need Unit (both measures are represented in standard scores)



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County) had school effects more than one standard deviation above the mean.

Ratio Analysis. The ratio analysis adheres more closely to the classical definition of efficiency as the ratio of outputs to inputs than does the quadriform approach. In this application, the school effect measure is divided by the expenditure measure; both measures are the same as used in the modified quadriform analysis. Like the modified quadriform analysis, ratio analysis is a measure of economic efficiency. The boundaries of the quartiles of efficiency of this analysis are represented by the diagonal lines superimposed on the modified quadriform analysis as shown in Figure 6. The most efficient quartile of schools (furthest to the left) now includes a few very high performing school districts with expenditures slightly above average for the sample. It also includes a few school districts that are below average in school effect but much below average in expenditure per pupil. The districts in this quartile are disproportionately from outside the Buffalo metropolitan area. The least efficient quartile (furthest to the right) includes some districts above average in effectiveness, but much above average in expenditure. This quartile also includes some districts that have very low school effects but are only slightly below average in expenditure.

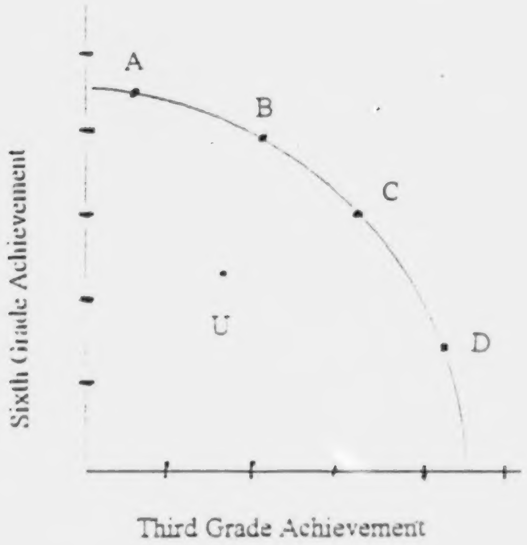
Most of the districts in the second and third quartiles are near average in school effect and expenditure. The second quartile includes some very high achieving school districts with expenditures only slightly above average. The second quartile also includes a few districts with school effects slightly below average and expenditures considerably below average. The third quartile is made up mostly of districts whose school effect is slightly below average and whose expenditures are near average. A few high school effect districts with very high expenditures also fall into this quartile.

Data Envelopment Analysis. The third procedure used to measure school district efficiency was a process known as data envelopment analysis (DEA). DEA uses linear programming concepts to determine the efficiency of an organization in using its resources in terms of outcomes achieved. Charnes, Cooper and Rhodes (1978) described DEA as "a method for adjusting data to prescribed theoretical requirements such as optimal production surfaces, etc., prior to undertaking various statistical tests for public policy analysis" (p. 4). Figure 7 illustrates a hypothetical production possibilities curve for third and sixth grade achievement. Efficient districts lie on the curve, e.g., A, B, C and D. District U is inefficient because it is inside the curve and not on its surface. To become efficient, district U would have to modify the use of its resources to more closely reflect practice found in the efficient districts.

DEA is preferable to either ratio analysis or regression analysis in determining the efficiency of organizations that produce multiple outputs (see Bowlin, Charnes, Cooper and Sherman, 1985; Banker, Conrad and Strauss, 1986; Sherman, 1986; Sexton, 1986; Charnes, Cooper, Divine, Ruefli & Thomas, 1989; Seiford and Thrall, 1990). A number of advantages of the DEA approach are particularly relevant to education (see Sexton, 1986; and Sexton, Silkman and Hogan, 1986):

1) DEA can simultaneously handle multiple inputs and outputs.

Figure 7. An Hypothetical Production Possibilities Curve for Third and Sixth Grade Achievement



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2) DEA does not require parametric specification of the relationships between inputs and outcomes.

3) Managerial strategies for improvement of inefficient decision-making units can be determined. Returns to scale information may also be available.

4) DEA can be used to determine either technical or economic efficiency, if appropriate information is available.

The primary limitation of DEA is that it is an extremal technique, and thus is sensitive to inaccurate data. It is also unable to provide measures of statistical association between inputs and outputs and this makes it more difficult to choose among different model specifications.

It should be noted that DEA determines strict inefficiency. In some cases, good performance in some areas may result in a relatively high efficiency rating even if performance in other areas is mediocre. Given the input and output combinations of all the organizations, data envelopment analysis attempts to optimize the relative efficiency rating of an organization. In determine relative efficiency, the DEA approach compares the district to all other districts in order to determine whether some weighted combination of those districts (subject to appropriate constraints) can outperform the district under consideration. If such a weighted combination can be determined, the district is deemed to be inefficient; if not, the district is regarded as efficient. Thus, if it is possible for an organization to be evaluated as efficient, the analysis will identify it as such. A district will be regarded as inefficient only if it truly is inefficient in relation to other districts. Thus, this technique errs toward efficiency, that is, placement of a district in the fourth quartile (least efficient) is most reliable and placement in one of the other quartiles is more likely to be subject to possible error.

Two DEA analyses were done, one looking at technical efficiency (DEA Technical Efficiency Model) and the other looking at economic efficiency (DEA Economic Efficiency Model). For the technical efficiency model, the outputs are the four school effect scores; the input measures are the number of teachers, the number of other professionals, and the number of para-professionals per EDNEED (the same measure used in the modified quadriform and ratio analyses). The outputs for the economic efficiency model are the same as for the technical efficiency model; but the inputs are measured solely by the amount of the operating expenditure per EDNEED.

The DEA economic efficiency model is most similar to the modified qaudriform and ratio analyses in concept and in results. With two exceptions, all of the districts in the most efficient quartile of the economic efficiency model are below average in expenditure and are disproportionately from outside the Buffalo metropolitan area. Most (16 out of 25) are above average in school effect. Those that are below average in school effect are well below average in expenditure. With two exceptions, all of the districts in the fourth quartile of efficiency as projected by this model are above average in expenditure and 17 out of 25 are below average in school effect.

The DEA technical efficiency model is the only model investigated that attempts to measure technical efficiency. It has identified districts as efficient (first quartile) that fell in all four quartile rankings of the other models studied. Six of the twenty-five districts in the most efficient quartile are above average in expenditure; sixteen are above average in school effect. Thirteen are in the Buffalo metropolitan area, an over representation from that expected. Likewise, this model has identified districts as being inefficient (lowest quartile) that fell in all quartiles of efficiency as identified by the other models and includes all levels of school effect and expenditures and rural, suburban and urban districts.

Discussion. There is not perfect agreement among the four models as to which districts are deemed efficient and which are deemed inefficient. This is not wholly unexpected since the DEA technical efficiency model measures a different concept of efficiency (technical) than do the other models (economic). Ten districts were identified as being consistently in the most efficient quartile by all four models (Akron, Frontier, Hinsdale, Letchworth, Lyndonville, Newfane, Panama, Pioneer, Portville, and Springville). Four other districts (Allegany/Limestone, Angelica, Olean and Randolph) were identified as being consistently in the most efficient quartile by the three economic models. Nine districts were identified as being in the least efficient quartile by all four models. Six others were consistently identified as being in the least efficient quartile by the three economic efficiency models.

All of the consistently efficient districts were above average in school effect with an average standard score of +.79. On the other hand, all of their expenditures per EDNEED were below average with their average being one standard deviation below the mean. The school effect score for all of the consistently inefficient schools was below average with an average standard score for the group of -.74. All of their expenditures per EDNEED were above average for the sample with the average being one standard deviation above the mean.

It is interesting to note that Maryvale moved from the least efficient quartile as determined by the models measuring economic efficiency to the most efficient quartile as determined by the model measuring technical efficiency. Earlier, Maryvale was given as an example of a district with a very experienced (and expensive) staff as the result of a dramatic drop in pupil enrollment two decades ago. When only the *cost* of the staff is taken into account, Maryvale appears to be inefficient. When only the *numbers* of staff employed are taken into account and not their cost, Maryvale appears to be efficient. As Maryvale's experienced staff retires and is replaced with less experienced persons, Maryvale's economic efficiency scores are likely to improve dramatically. This raises interesting questions about the efficacy of the ways we commonly remunerate teachers.

It is also interesting to note that school districts in the Buffalo metropolitan area are over-represented in the most efficient quartile according to the technical efficiency model. They had been under-represented in the top quartile according to all three economic efficiency models. Rural districts tend to have lower pupil to teacher ratios than do urban and suburban districts, ranking them lower on technical efficiency. On the other hand, rural districts pay less for their teachers and other staff, giving them an advantage on economic efficiency measures.

Table 1 reports the Pearson correlation coefficients among the four efficiency models. All are positively correlated with one another, and all relationships are highly significant. The quadriform and ratio models are the most closely correlated followed by the DEA efficiency and ratio models. As expected, the DEA technical model has the lowest correlations with the three economic efficiency models.

Table 2 shows the distribution of school district expenditures and effectiveness scores across the quartiles of the four efficiency models. The distributions show that the efficiency models are more sensitive to expenditure than they are to achievement. This is not surprising given the lack of a significant correlation between school district effect and expenditure.

Figures 8 and 9 illustrate graphically these inter-relationships for the two DEA models. The figures have the same configuration as Figure 6, but the districts are indicated by symbols reflecting the DEA quartiles in which they fall: a circle (first quartile, most efficient), a diamond (second), a triangle (third), and an inverted triangle (fourth, least efficient).

Table 1. Pearson Correlation Coefficient Matrix for the Four Efficiency Models

Correlations	Quadriform	Ratio	DEA Efficiency	DEA Technical
Quadriform	1.000	.737 p=.000	.535 p=.000	.275 p=.005
Ratio	.737 p=.000	1.000	.721 p=.000	.361 p=.000
DEA Efficiency	.535 p=.000	.721 p=.000	1.000	.433 p=.000
DEA Technical	.275 p=.005	.361 p=.000	.433 p=.000	1.000

School Efficiency

The school efficiency analysis is the most tentative of the analyses we did because of the limited amount of data available at the school level. Output measures are available from the state tests as for the district analyses; but, for the input measures, only the numbers of personnel in three categories (teachers, para-professionals, and other professionals) were known to us. This type of analysis will become much more valuable as the quality and scope of the data improve. We report our findings here to illustrate the kind of policy relevant information efficiency analyses at the school level may yield in the future.

School efficiency was measured using data envelopment analysis and ratio analysis. In both cases, only technical efficiency was addressed since adequate expenditure data at the school level were not available, thereby preventing economic efficiency analyses. The large number of grade configurations in the schools prevented us from comparing all schools simultaneously. Instead, it was necessary to divide the schools into five categories based on the grades offered: Elementary Schools; Middle Schools; Junior/Senior High Schools; High Schools; and, Comprehensive Schools. The distribution of schools among the categories is reported in Table 3. Due to the small number of schools compared to the number of tests, no efficiency analyses were conducted for Comprehensive Schools.

Ratio Analysis. In calculating the ratios, an average of the available school effect measures for each school was used as the output measure (numerator). Inputs were measured using the number of persons employed in each personnel category per student enrolled; e.g., teachers per student). The results were weighted and combined to create the denominator of the ratio. The weights used to combine the personnel were 1.0 for teachers, 0.5 for para-professionals and 1.2 for other professionals. These weights are arbitrary; however, there is little evidence to either refute or support these, or other, weights. (See discussion below.)

Table 2. Distribution of School District Expenditure and Effectiveness for Four Efficiency Models by Quartile

DEA	Expenditures					Effectiveness				
	<- lowest to highest->					<- highest to lowest ->				
Technical	1	2	3	4	Total	1	2	3	4	Total
Quartile 1	10	9	2	4	25	8	8	8	1	25
Quartile 2	5	9	8	4	26	3	7	7	9	26
Quartile 3	6	5	9	5	25	9	5	4	7	25
Quartile 4	4	3	6	12	25	5	6	6	8	25
Total	25	26	25	25	101	25	26	25	25	101

DEA	Expenditures					Effectiveness				
	<- lowest to highest->					<- highest to lowest ->				
Economic	1	2	3	4	Total	1	2	3	4	Total
Quartile 1	19	4	2	0	25	8	8	5	4	25
Quartile 2	5	13	6	2	26	6	8	5	7	26
Quartile 3	1	7	10	7	25	8	5	8	4	25
Quartile 4	0	2	7	16	25	3	5	7	10	25
Total	25	26	25	25	101	25	26	25	25	101

	Expenditures					Effectiveness				
	<- lowest to highest->					<- highest to lowest ->				
Ratio	1	2	3	4	Total	1	2	3	4	Total
Quartile 1	16	5	3	1	25	13	9	2	1	25
Quartile 2	5	8	7	6	26	9	9	6	2	26
Quartile 3	2	10	9	4	25	1	6	11	7	25
Quartile 4	2	3	6	14	25	2	2	6	15	25
Total	25	26	25	25	101	25	26	25	25	101

	Expenditures					Effectiveness				
Quadri-	<- lowest to highest->					<- highest to lowest ->				
form	1	2	3	4	Total	1	2	3	4	Total
Quartile 1	25				25	25				25
Quartile 2		26			26		26			26
Quartile 3			25		25			25		25
Quartile 4				25	25				25	25
Total	25	26	25	25	101	25	26	25	25	101

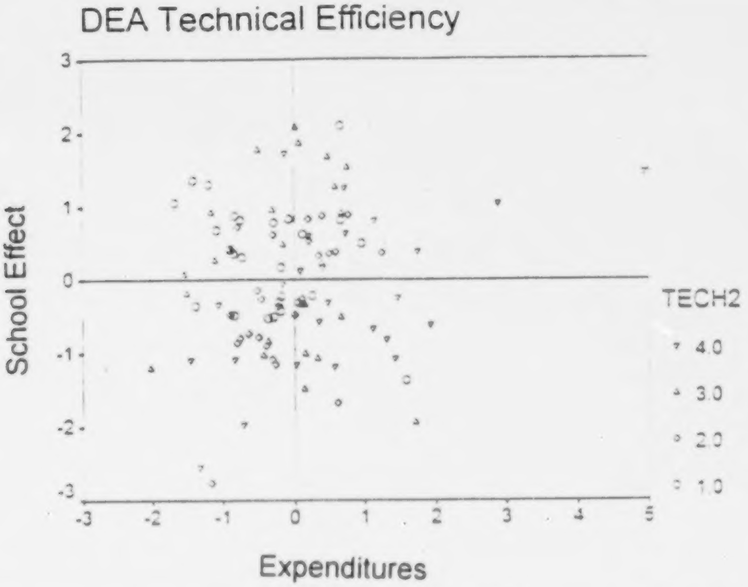

Figure 8. Location of Districts According to DEA Technical Efficiency Quartile in Bivariate Distribution of Average School Effect and Adjusted Expenditure per Educational Need Unit (both measures are represented in standard scores)

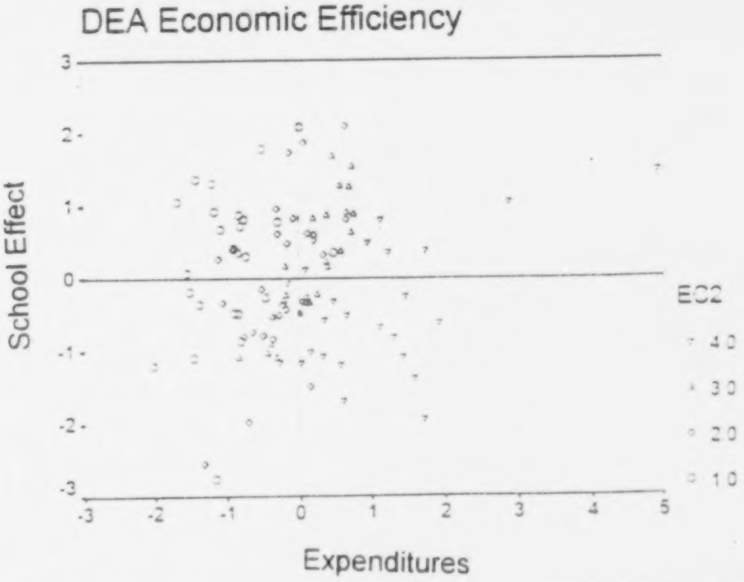

Figure 9. Location of Districts According to DEA Economic Efficiency Quartile in Bivariate Distribution of Average School Effect and Adjusted Expenditure per Educational Need Unit (both measures are represented in standard scores)

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Table 3. Distribution of Schools by Category for Efficiency Analysis

Elementary Schools. Schools reporting scores for the grade 3 or 4 tests and *possibly* other tests for the elementary grades

- 10 schools reporting scores for grade 3 only
- 34 schools reporting scores for grades 3 and 4
- 92 schools reporting scores for grades 3 through 5
- 46 schools reporting scores for grades 3 through 6
- 40 schools reporting scores for grades 3 through 8
- 3 schools reporting scores for grades 4 and 5
- 4 schools reporting scores for grades 4 through 6
- 1 school reporting scores for grades 4 through 8

Middle Schools. Schools reporting test scores for grades 5, 6 or 8

- 12 schools reporting scores for grades 5 through 8
- 8 schools reporting scores for grades 5 and 6
- 36 schools reporting scores for grades 6 and 8
- 6 schools reporting scores for grade 8 only

Junior/Senior High Schools. Junior high school grades as well high school in the same building. Schools included in this group reported test scores for grades 5, 6 or 8 as well as the high school Regents exams.

- 10 schools reporting scores for grades 5 or 6 through 8 plus high school
- 36 schools reporting scores for grade 8 plus high school

High Schools. This group included high schools only.

- 60 schools reporting scores for Regents examinations only

Comprehensive Schools. Thirteen schools provide classes from kindergarten through grade 12. Due to the small number of schools compared to the number of tests, no efficiency analyses were conducted for these schools. Twelve of these schools were in rural areas and one was in a small city.

Table 4 provides the distribution of ratio-efficiency of schools by quartiles (1 being the most efficient and 4 the least efficient) by school classification and district type (Buffalo, small city, suburban/rural [non-city school districts in Chautauqua, Erie, Genesee, Niagara, and Orleans Counties], and rural [non-city school districts in Allegany, Cattaraugus and Wyoming Counties]) Both the number of schools included in each quartile and the percents of the total number of schools in the category are provided. For the elementary schools, most of the efficient schools are small city and suburban/rural schools, representing 39% and 30%, respectively, of the schools of that type included in the elementary group. In general, these schools are above average in school effect and well below average in the number of personnel working in the schools. The least efficient schools are primarily in Buffalo and suburban/rural area, representing 50% and 22%, respectively, of the schools of those types included in the elementary category. These schools are well below average in school effect and above average in terms of the number of personnel employed. Schools in the second and third quartiles are close to average in school effect. The schools in the third quartile tend to have more personnel in each category than those in the second quartile (which has more than those in the first quartile). Table 5 organizes the statistics in reverse order, that is, by district type and school classification.

For the other three school categories, Tables 4 and 5 indicate that the suburban/rural and rural schools have more schools in the more efficient quartiles (1 and 2) than in the less efficient quartiles. In particular, for middle schools and high schools, approximately two-thirds of the schools in these groups are in quartiles 1 and 2. On the other hand the urban schools (in Buffalo and the small cities) fare considerably worse with a majority of their schools classified as inefficient (quartiles 3 or 4).

For the middle schools, the patterns of school effects and numbers of personnel were as expected and were similar to the elementary schools. However, for junior/senior high schools, the numbers of personnel increased steadily from the first to the fourth efficiency quartile, as expected, but the school effects were approximately the same (and below average) for the second, third and fourth quartiles. For high schools, the patterns were as expected (decreasing school effects and increasing personnel) as one moved from the first to the fourth quartile.

Data Envelopment Analysis. Due to the different combinations of test scores reported for the elementary, middle and junior/senior high school categories, an average school effect was determined in relation to all available school effect scoresfor each school. It should be noted that for the junior/senior high school group, two DEA analyses were conducted, one using an elementary school effect score and a high school effect score and the other using an average school effect score based on all available school effects scores. The correlation between the two was quite high (r = .88); therefore, in the interest of consistency with the other categories reporting a variety of different test scores, only the results of the analysis based on a single school effect score are reported. The DEA evaluation for the high school group is based on the three separate school effect scores. In all cases school inputs are measured by the number of personnel per student enrolled for all three categories of personnel.

Table 4. Representation in Ratio Efficiency Quartiles
by 1) School Category and 2) District Type

Elementary Schools

District Type	Number of schools					Percent				
	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
Buffalo	3	6	13	22	44	6.8	13.6	29.5	50.0	100
Small city	19	17	5	8	49	38.8	34.7	10.2	16.3	100
Suburban/Rural	35	26	30	25	116	30.2	22.4	25.9	21.6	100
Rural	0	9	9	3	21	0.0	42.9	42.9	14.3	100
Total	57	58	57	58	230					

Middle schools

District Type	Number of schools					Percent				
	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
Buffalo			1	1	2	0.0	0.0	50.0	50.0	100
Small city		2	6	8	16	0.0	12.5	37.5	50.0	100
Suburban/Rural	14	13	7	7	41	34.1	31.7	17.1	17.1	100
Rural	1	1	1		3	33.3	33.3	33.3	0.0	100
Total	15	16	15	16	62					

Junior/ Senior High Schools

District Type	Number of schools					Percent				
	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
Buffalo	1		1	2	4	25.0	0.0	25.0	50.0	100
Small city				1	1	0.0	0.0	0.0	100.0	100
Suburban/Rural	7	8	6	7	28	25.0	28.6	21.4	25.0	100
Rural	3	4	4	2	13	23.1	30.8	30.8	15.4	100
Total	11	12	11	12	46					

High Schools

District Type	Number of schools					Percent				
	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
Buffalo	1		3	7	11	9.1	0.0	27.3	63.6	100
Small city	1	3	3	3	10	10.0	30.0	30.0	30.0	100
Suburban/Rural	13	11	8	4	36	36.1	30.6	22.2	11.1	100
Rural		1	1	1	3	0.0	33.3	33.3	33.3	100
Total	15	15	15	15	60					

Table 5. Representation in Ratio Efficiency Quartiles
by 1) District Type and 2) School Category

Buffalo	Number of schools					Percent				
	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
Elementary	3	6	13	22	44	6.8	13.6	29.5	50.0	100
Middle School			1	1	2	0.0	0.0	50.0	50.0	100
Jr/Sr High School	1		1	2	4	25.0	0.0	25.0	50.0	100
High School	1		3	7	11	9.1	0.0	27.3	63.6	100
Total	5	6	18	32	61	8.2	9.8	29.5	52.5	100

Small City	Number of schools					Percent				
	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
Elementary	19	17	5	8	49	38.8	34.7	10.2	16.3	100
Middle School	0	2	6	8	16	0.0	12.5	37.5	50.0	100
Jr/Sr High School	0	0	0	1	1	0.0	0.0	0.0	100.0	100
High School	1	3	3	3	10	10.0	30.0	30.0	30.0	100
Total	20	22	14	20	76	26.3	28.9	18.4	26.3	100

Suburban/Rural	Number of schools					Percent				
	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
Elementary	35	26	30	25	116	30.2	22.4	25.9	21.6	100
Middle School	14	13	7	7	41	34.1	31.7	17.1	17.1	100
Jr/Sr High School	7	8	6	7	28	25.0	28.6	21.4	25.0	100
High School	13	11	8	4	36	36.1	30.6	22.2	11.1	100
Total	69	58	51	43	221	31.2	26.2	23.1	19.5	100

Rural	Number of schools					Percent				
	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
Elementary	0	9	9	3	21	0.0	42.9	42.9	14.3	100
Middle School	1	1	1	0	3	33.3	33.3	33.3	0.0	100
Jr/Sr High School	3	4	4	2	13	23.1	30.8	30.8	15.4	100
High School	0	1	1	1	3	0.0	33.3	33.3	33.3	100
Total	4	15	15	6	40	10.0	37.5	37.5	15.0	100

Tables 6 and 7 report the results of the DEA efficiency evaluations. For the elementary schools, (Table 6) most of the efficient schools are small city and suburban/rural schools, representing 49% and 23%, respectively, of the schools of that type included in the elementary category. In general, these schools are above average in school effect and well below average in the number of personnel working in the schools. The least efficient schools are located primarily in Buffalo and the suburban rural area, representing 55% and 21%, respectively, of the schools of that type included in the elementary group.

It should be noted that the representation of schools in the DEA efficiency quartiles is very similar to that of the ratio efficiency quartiles. Furthermore, examination of the pattern of relative school effects and the relative numbers of personnel is also very similar. A closer examination of the consistency of the two models in placing schools in efficiency quartiles indicates that 64% of schools are placed in the same quartile, and 95% are placed within 1 quartile under the two methods. This degree of consistency is noteworthy, but additional research would have to be undertaken to determine whether this would usually be the case for this type of analysis.

Discussion. Thirty six elementary schools, thirteen middle schools, five junior/senior high schools and ten high schools were classified as efficient by both models. Of these schools, three were located in Buffalo, seventeen in small cities, forty in the suburban/rural area, and four in the rural area. These represent 5%, 22%, 18% and 10%, respectively, of the total schools in each of these categories. Furthermore, forty-five elementary schools, fifteen middle schools, ten junior/senior high schools, and ten high schools were classified as inefficient by both models. Of these, twenty-eight were located in Buffalo, sixteen in small cities, thirty-one in the suburban/rural area, and five in the rural area, representing 46%, 21%, 14% and 13% of the schools in each of these categories.

We have a number of concerns with respect to these analyses at the school level. First, as mentioned earlier, the combination of personnel was arbitrary. However, a limited sensitivity analysis indicated that the rankings of schools based on the efficiency ratios change only slightly for changes in the weights for the para-professionals and the professionals. Nevertheless, the choice of appropriate weights is an issue that will require further attention. A more serious problem is that we do not have a mechanism for weighting the numbers of *personnel* for pupils with various disabilities in the schools. The number of additional personnel required for disabled pupils may not be adequately incorporated into our analysis. This is a significant limitation and may explain the relatively poor performance of urban schools with respect to both efficiency measures--and the relatively strong performance of the suburban districts.

Policy Analysis Tools

The development of indices in the previous sections of this report have provided information that can be of use to policy makers (e.g., school boards, superintendents, and principals) in making global assessments of the effectiveness of their school operations in terms of student achievement adjusted and unadjusted for environmental factors. In this section, we provide a series of charts designed to assist in making comparisons among schools and school districts, that is,

Table 6. Representation in DEA Efficiency Quartiles by 1) School Category and 2) District Type

		Number of schools						Percent		
District Type	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
Buffalo	2	6	12	24	44	4.5	13.6	27.3	54.5	100
Small city	24	9	11	5	49	49.0	18.4	22.4	10.2	100
Suburban/Rural	27	38	27	24	116	23.3	32.8	23.3	20.7	100
Rural	4	5	7	5	21	19.0	23.8	33.3	23.8	100
Total	57	58	57	58	230					

Middle Schools

		Number of schools						Percent		
District Type	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
Buffalo	0	0	2	0	2	0.0	0.0	100.0	0.0	100
Small city	0	2	6	8	16	0.0	12.5	37.5	50.0	100
Suburban/Rural	14	13	7	7	41	34.1	31.7	17.1	17.1	100
Rural	1	1	1	0	3	33.3	33.3	33.3	0.0	100
Total	15	16	16	15	62					

Junior/Senior High Schools

		Number of schools						Percent		
District Type	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
Buffalo	2	0	1	1	4	50.0	0.0	25.0	25.0	100
Small city	0	0	0	1	1	0.0	0.0	0.0	100.0	100
Suburban/Rural	6	9	6	7	28	21.4	32.1	21.4	25.0	100
Rural	3	3	4	3	13	23.1	23.1	30.8	23.1	100
Total	11	12	11	12	46					

High School

		Number of schools						Percent		
District Type	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
Buffalo	3	0	2	6	11	27.3	0.0	18.2	54.5	100
Small city	1	0	5	4	10	10.0	0.0	50.0	40.0	100
Suburban/Rural	11	13	8	4	36	30.6	36.1	22.2	11.1	100
Rural	0	2	0	1	3	0.0	66.7	0.0	33.3	100
Total	15	15	15	15	60					

All Categories

		Number of schools								Percent
District Type	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
Buffalo	7	6	17	31	61	11.5	9.8	27.9	50.8	100
Small city	25	11	22	18	76	32.9	14.5	28.9	23.7	100
Suburban/Rural	58	73	48	42	221	26.2	33.0	21.7	19.0	100
Rural	8	11	12	9	40	20.0	27.5	30.0	22.5	100
Total	98	101	99	100	398					

Table 7. Representation in DEA Efficiency Quartiles
by 1) District Type and 2) School Category

Buffalo	Number of schools					Percent				
	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
Elementary	2	6	12	24	44	4.5	13.6	27.3	54.5	100
Middle School	0	0	2	0	2	0.0	0.0	100.0	0.0	100
Jr/Sr High School	2	0	1	1	4	50.0	0.0	25.0	25.0	100
High School	3	0	2	6	11	27.3	0.0	18.2	54.5	100
	7	6	17	31	61	11.5	9.8	27.9	50.8	100

Small City	Number of schools					Percent				
	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
Elementary	24	9	11	5	49	49.0	18.4	22.4	10.2	100
Middle School	0	2	6	8	16	0.0	12.5	37.5	50.0	100
Jr/Sr High School	0	0	0	1	1	0.0	0.0	0.0	100.0	100
High School	1	0	5	4	10	10.0	0.0	50.0	40.0	100
	25	11	22	18	76	32.9	**14.5**	**28.9**	**23.7**	**100**

Suburban/Rural	Number of schools					Percent				
	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
Elementary	27	38	27	24	116	23.3	32.8	23.3	20.7	100
Middle School	14	13	7	7	41	34.1	31.7	17.1	17.1	100
Jr/Sr High School	6	9	6	7	28	21.4	32.1	21.4	25.0	100
High School	11	13	8	4	36	30.6	36.1	22.2	11.1	100
	58	73	48	42	221	26.2	33.0	21.7	19.0	100

Rural	Number of schools					Percent				
	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
Elementary	4	5	7	5	21	19.0	23.8	33.3	23.8	100
Middle School	1	1	1	0	3	33.3	33.3	33.3	0.0	100
Jr/Sr High School	3	3	4	3	13	23.1	23.1	30.8	23.1	100
High School	0	2	0	1	3	0.0	66.7	0.0	33.3	100
	8	11	12	9	40	20.0	27.5	30.0	22.5	100

benchmarking. The charts will show policy makers where their resource allocation and performance profiles differ markedly from the norm for the western New York region. Differing from the norm is neither good nor bad in and of itself. Differing significantly from the norm may be the key to success for highly efficient, high achieving districts. On the other hand, differing significantly from the norm for low achieving, low efficiency school districts may prove to be the key to failure. It isn't the deviation from the norm, but rather the rationale for the deviation, that is critical. If the deviation is the result of deliberate district policy, the deviation is probably justified. More often than not, however, the deviation is the result of "drift" as a result, for example, of a changing profile of students and/or the teaching staff, response to highly effective advocates for a particular program, or labor agreements or contracts with vendors that do not work in the district's best interest. Evaluating district policies that produce deviations from the norm is a good place to begin the long journey to improving district performance and stewardship.

Bernhardt (1998) notes that the power of charts and graphs comes from their ability to convey data directly to the viewer. Viewers use their spacial intelligence to retrieve data from a graph, complementing their language-based intelligence. Graphics display multiple measures, encouraging the eye to compare different pieces of data at several levels of detail. Graphs communicate information about relationships and the are especially effective in deepening or inducing understanding upon intensive inspection. They set the stage for discussion and analysis. "For most people, the communication process becomes more direct and immediate through graphic displays. Data become more credible and more convincing when the audience has direct interaction with it. Graphs allow us to move easily from the analytical to the descriptive and vice versa." (P. 181).

Analyzing School and School District Effectiveness

The standard score chart for assessing districts' relative performance with respect to aggregate student achievement and school effect was presented as Figure 2 (p. 9). The chart generated for assessing schools' relative performance was presented as Figure 3 (p. 9)[4]. Information useful in interpreting profiles drawn on these charts was presented in the discussions on pages 7-14.

Fifteen additional charts have been developed for analyzing relative performance at the school level. These were constructed the same way as the student achievement and school effect standard score charts were constructed, but they take on a different appearance. For these, only the standard deviation scale at the left appears the same. The bar for each achievement statistic shows the mean in raw scores (for example, actual average scores or percentages) as is the case for the amounts at one standard deviation intervals above and below the mean. These charts are

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[4] Aggregated school achievement and school effect data for all schools and districts in the study can be downloaded as Lotus or Excel spreadsheets from http://www.buffalo.edu/gse/fas/swanson/649. Once you reach this location, scroll down to item #5 and follow the instructions.

I.	Descriptive Information (1993-1996)
II.	Performance Related Measures (1992-1995)
III.	Grade 3 Reading & Mathematics Achievement (1993-1996)
IV.	Grade 4 Science Achievement (1995-1996)
V.	Grade 5 Writing Achievement (1993-1996)
VI.	Grade 6 Reading, Mathematics & Social Studies Achievement (1993-1996)
VII.	Grade 8 Social Studies Achievement (1995-1996)
VIII.	English Regents Achievement (1993-1996)
IX.	U. S. History & Government Regents Achievement (1993-1996)
X	Global Studies Regents Achievement (1993-1996)
XI	Languages Other Than English Regents Achievement (1993-1996)
XII	Mathematics I & III Regents Achievement (1993-1996)
XIII	Biology Regents Achievement (1993-1996)
XIV	Chemistry Regents Achievement (1993-1996)
XV	Introduction to Occupations Regents Achievement (1993-1996)

Data to be used for plotting a school's profile may be obtained from the school's *1996 New School York State School Report Card*[5]. Profiles may be plotted for the school's average achievement, the district's average achievement, and the average achievement of schools statewide with similar demographic characteristics. The school's profile may also be compared with reference schools of one's own preference. For illustrative purposes, profiles are shown in subsequent figures for Drake Elementary School, Lowry Middle School, and North Tonawanda High School in the North Tonawanda School District. School average achievement (————) in these illustrations are compared with district averages (—— - ——) and average performance of similar schools(--------------).

Drake Elementary School Achievement Chart I, Figure 10, shows descriptive information about the percentage of pupils receiving free lunch (a measure of socio-economic status) and percent of pupils with limited English proficiency. In terms of "Percent Pupils Receiving Free Lunch," Drake is nearly one standard deviation below the mean; in other words, it is relatively affluent for the region and slightly more affluent than other schools in the district. Its

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[5] *1996 New York State School Report Card* data for all Western New York schools and districts can be accessed via the internet at <http://rin.buffalo.edu/default.html>. Upon reaching the site, follow the steps listed below:

1 click on the hyperlink;
2 click on the county in which the school is located;
3 click on "Education;"
4 click on "Public Schools;"
5 click on the name of the school of interest;
6 click on "New York State 1996 School Report Card" and find the data that you want to record.

Figure 10 Achievement Chart I: Descriptive Information (1993-1996), for Drake Elementary School and the North Tonawanda School District

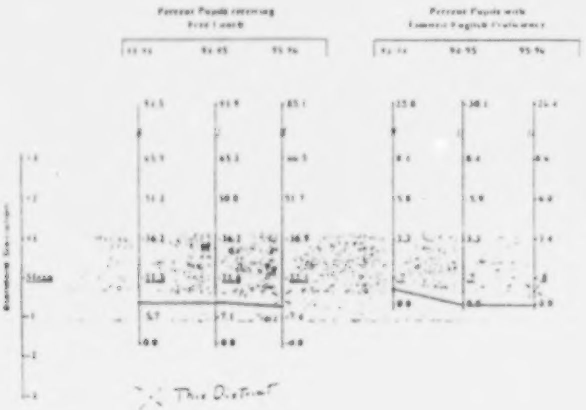


Figure 11. Achievement Chart IIA: Performance Related Measures (1993-1996), for Drake Elementary School

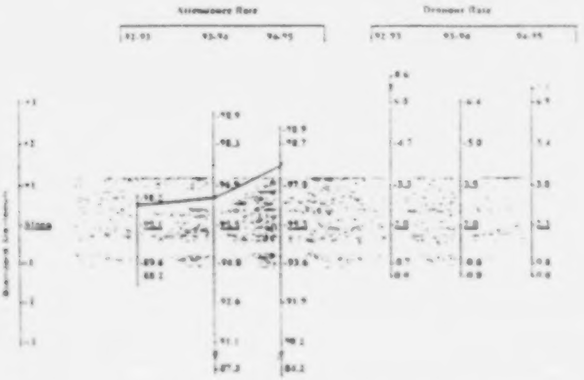
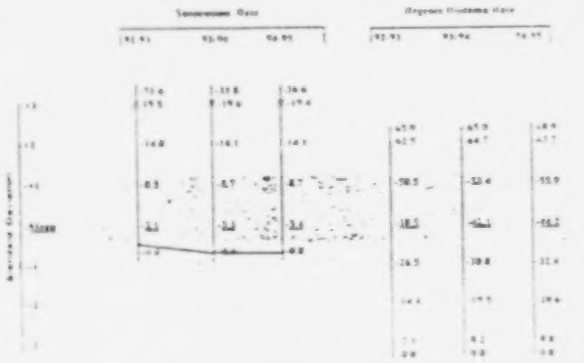


Figure 12. Achievement Chart IIB: Descriptive Information (1993-1996), for Drake Elementary School



"Percent of Pupils with Limited English Proficiency" is zero, low for the region and for the district.

Its "Attendance Rate" is generally high and more than one standard deviation above the regional mean for 1994-1995 as shown in Achievement Chart IIA (Figure 11). The "Suspension Rate" for Drake is zero as shown in Achievement Chart IIB (Figure 12). "Dropout Rate" and "Regents Diploma Rate" do not pertain to elementary schools.

Chart III (Figure 13) shows Drake's third grade achievement in mathematics and reading. Its performance tends to fall in the middle range. Chart IV (Figure 14) reports fourth grade science achievement and Chart V (Figure 14) reports on writing achievement in grade five, again, its performance tends to be in the middle range.

Lowry Middle School. Achievement Charts I and II are repeated for Lowry Middle School (Figures 15, 16 and 17). Lowry's student population is less affluent than Drake's, its "Percent Pupils Receiving Free Lunch" is about average for the region and above the district percentage. For 1992-1993 and 1993-1994, its "Attendance Rate" was in the average range for the region, but, in 1994-1995, it showed a dramatic improvement. The school's "Suspension Rate" falls into the middle range.

Achievement Chart VIA (Figure 18) reports on reading and mathematics achievement for grade six. Its profiles fall into the middle range as do those for the district and similar schools. Figure 19 shows the profiles for Achievement Charts VIB & VII, social studies achievement for grades six and eight (1995-1996). The school's performance falls into the middle range for grade six as do the reference groups. At grade eight, the school's performance is consistently more than one standard deviation above the mean while the reference groups remain in the middle range. Figures 20 and 21 report performance on the Mathematics I Regents Examinations. For both percent mastery and percent passing, the school's record is low for the district, but similar to that for similar schools. This may be the case because most students taking the Mathematics I Regents Examination are in ninth grade rather than eighth.

North Tonawanda High School. Achievement Charts I and II are repeated for North Tonawanda High School (Figures 22, 23 and 24). The high school's profiles on these charts tend to fall in the middle range for the distribution and are similar to those of similar schools. Figures 25 through 33 (Achievement Charts VIII through XV) show the profiles of percent of students passing and percent achieving mastery on each Regents examination. The pupils of the school consistently achieve in the middle range of the distribution.

Analyzing School District Fiscal Policy

Charts designed to assist in assessing school district fiscal policy were constructed the same way as the student achievement and school effect standard score charts were constructed. The standard deviation scale appears at the left of each chart. The bar for each expenditure category shows the mean in raw scores (for example, actual dollars, percentages, etc.) as is the

Figure 13. Achievement Chart III Grade 3 Reading and Mathematics Achievement (1993-1996), for Drake Elementary School, the District and Similar Schools
This School (————) This District (—— - ——) Similar Schools (— — — — -)

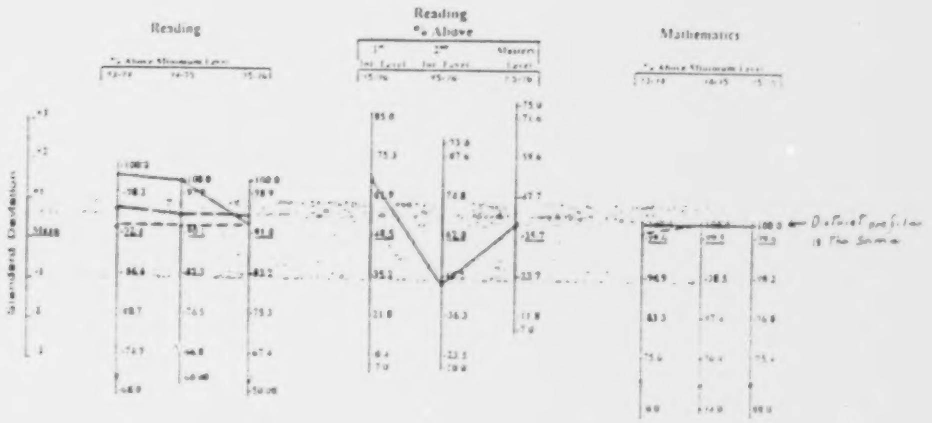


Figure 14. Achievement Charts IV & V: Grade 4 Science Achievement (1995-1996) and Grade 5 Writing Achievement (1993-1996), for Drake Elementary School, the District and Similar Schools
This School (————) This District (—— - ——) Similar Schools (— — — — -)

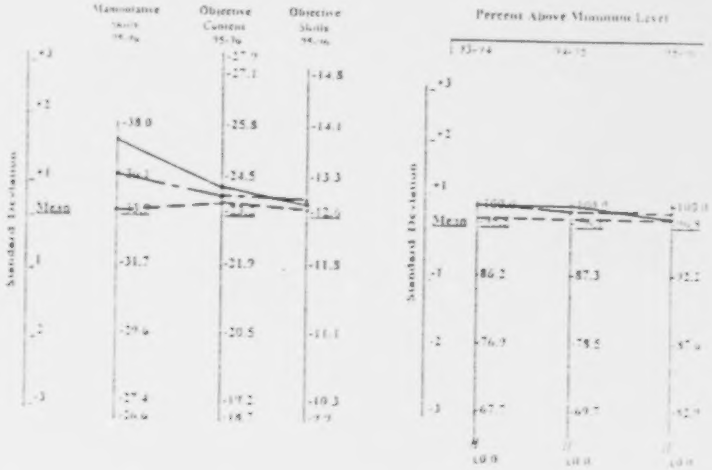


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Figure 15. Achievement Chart I: Descriptive Information (1993-1996), for Lowry Middle School and the North Tonawanda School District

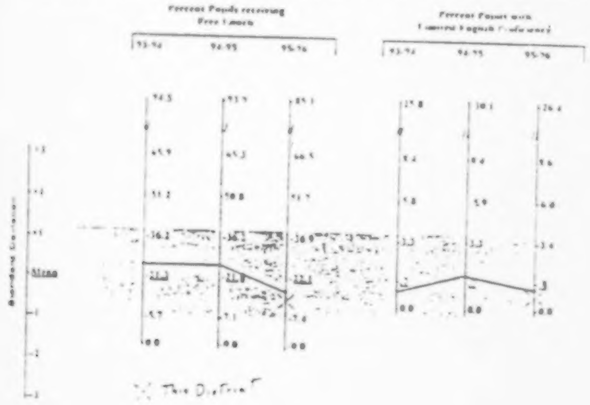


Figure 16. Achievement Chart IIA: Performance Related Measures (1993-1996), for Lowry Middle School

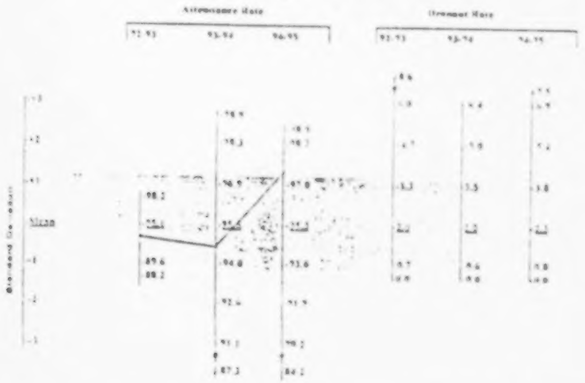


Figure 17. Achievement Chart IIB: Descriptive Information (1993-1996), for Lowry Middle School

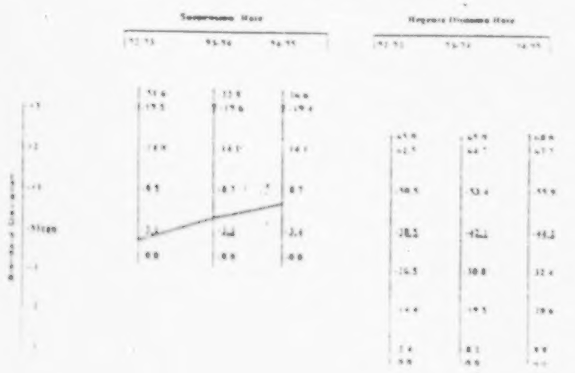
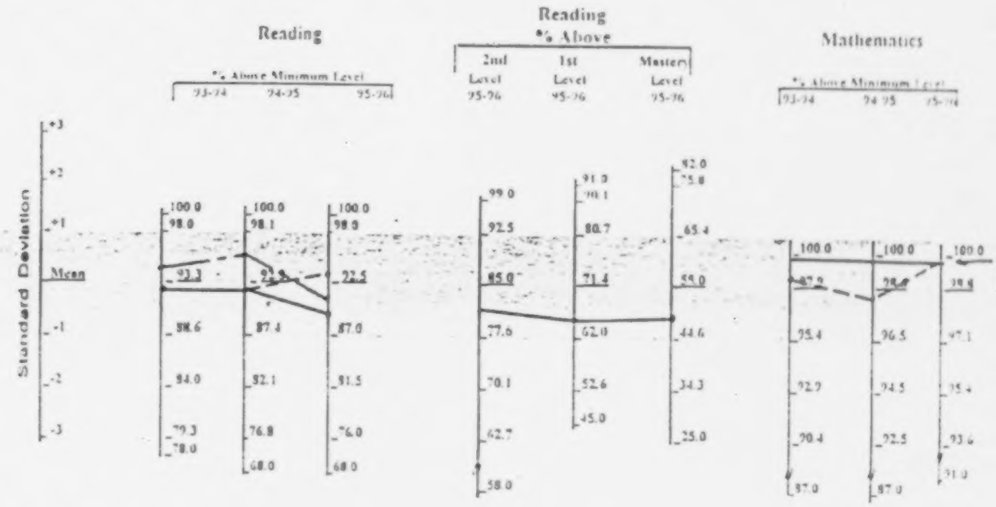


Figure 18. Achievement Chart VIA: Grade 6 Reading and Mathematics Achievement (1993-1996), for Lowry Middle School, the District and Similar School
This School (————) This District (—— - ——) Similar Schools (— — — —)



Distict profile is the same.

Figure 19. Achievement Charts VIB & VII: Grades 6 and 8 Social Studies Achievement (1995-1996), for Lowry Middle School, the District and Similar Schools
This School (————) This District (—— - ——) Similar Schools (— — — —)

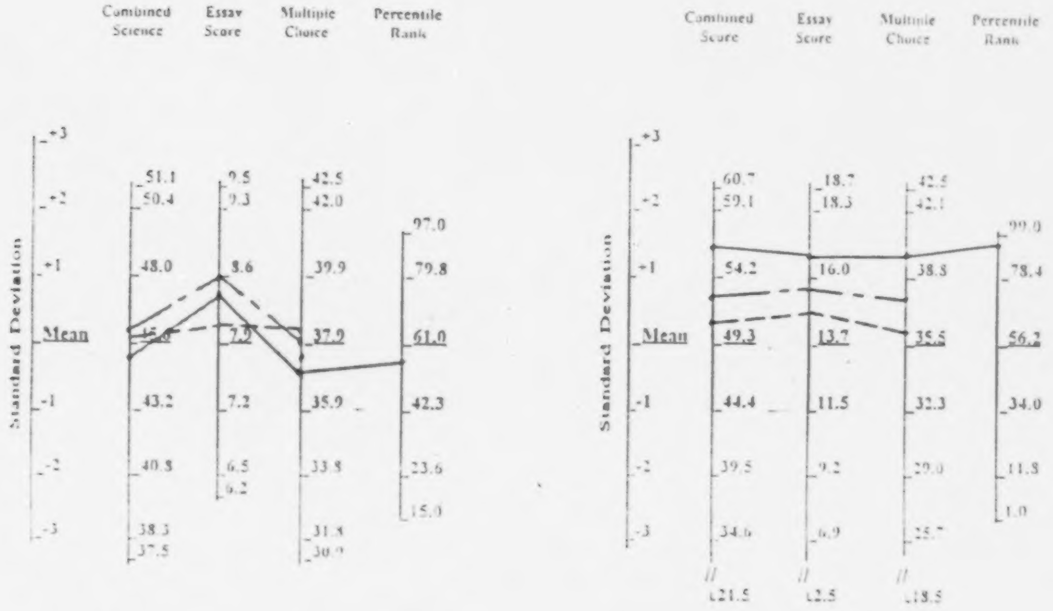


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Figure 20. Achievement Chart XIIA: Percent Mastery of Mathematics I and III Regents Achievement (1993-1996), for Lowry Middle School, the District and Similar Schools
This School (————) This District (—— – ——) Similar Schools (— — — -)

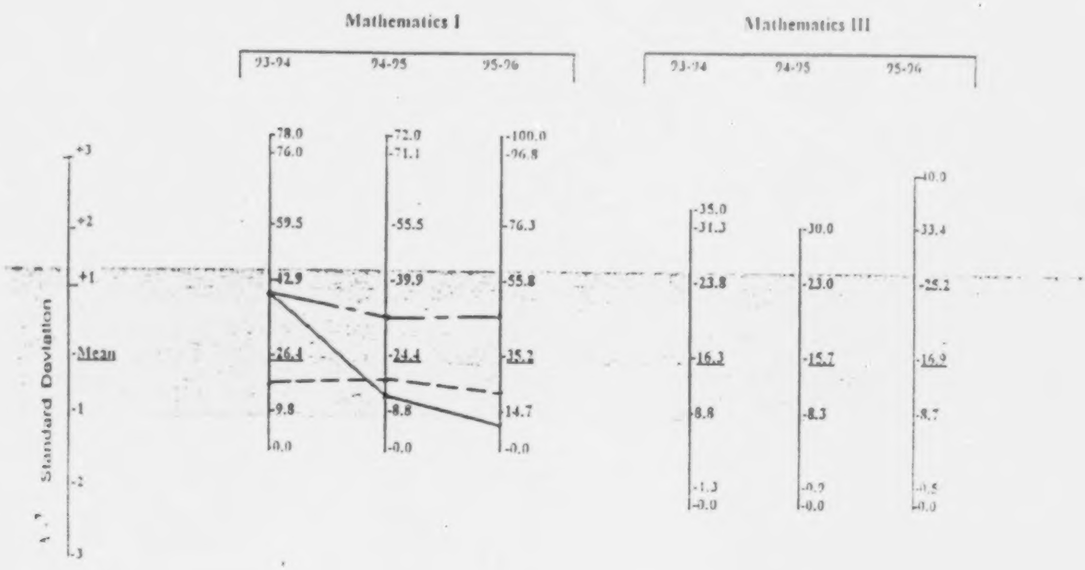

Figure 21. Achievement Chart XIIB: Percent Passing Mathematics I and III Regents Achievement (1993-1996), for Lowry Middle School, the District and Similar Schools
This School (————) This District (—— - ——) Similar Schools (— — — — -)

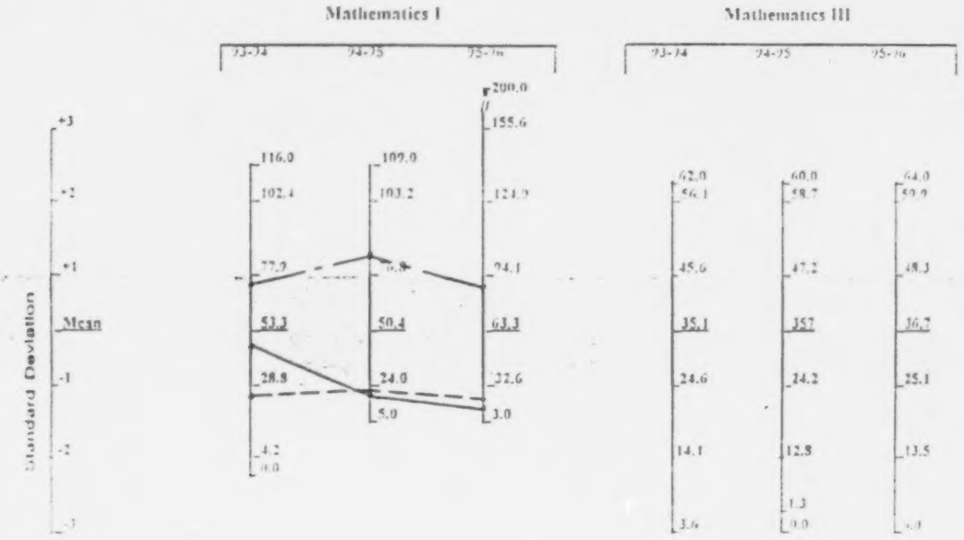

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Figure 22. Achievement Chart I: Descriptive Information (1993-1996), for North Tonawanda High School and the North Tonawanda School District

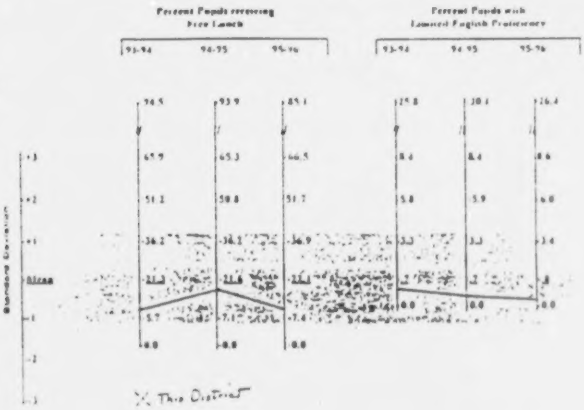

Figure 23. Achievement Chart IIA: Performance Related Measures (1993-1996), for North Tonawanda High School

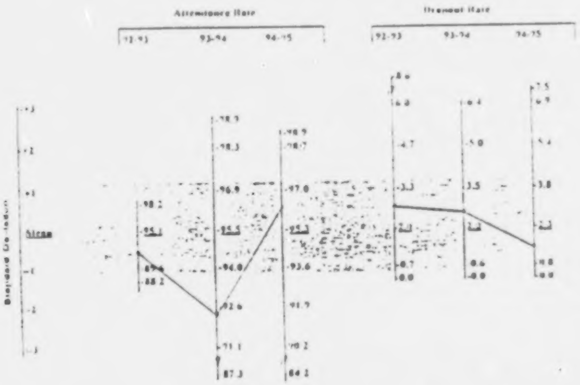

Figure 24. Achievement Chart IIB: Descriptive Information (1993-1996), for North Tonawanda High School and Similar Schools

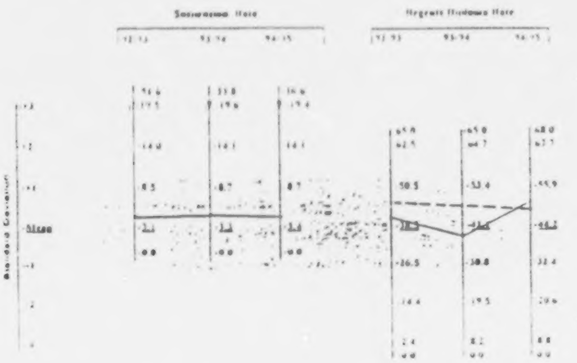

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Figure 25. Achievement Chart VIII: English Regents Achievement (1993-1996), for North Tonawanda High School and Similar Schools
This School (————) Similar Schools (— — — —)

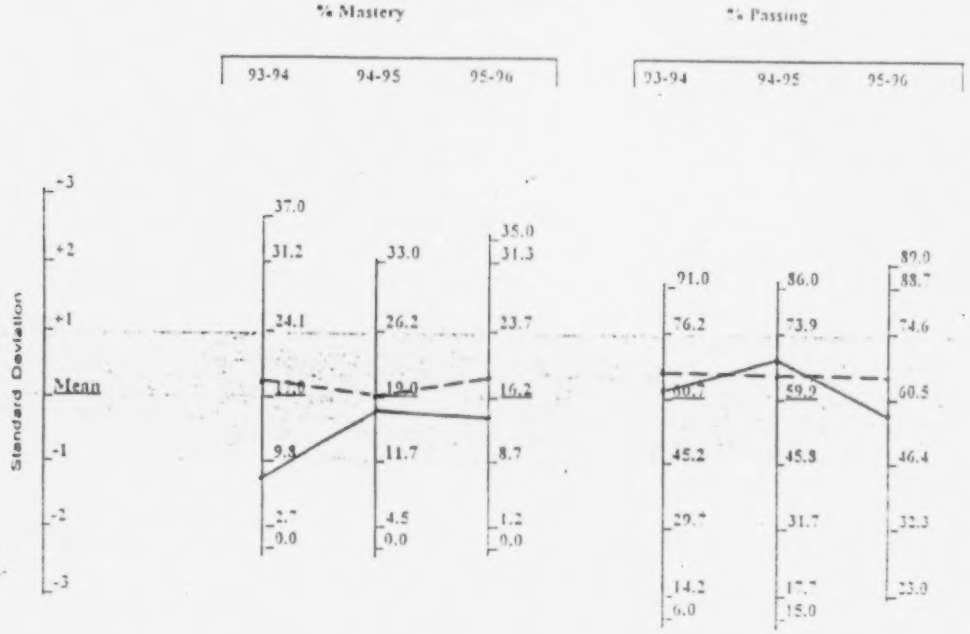

Figure 26. Achievement Chart IX: U. S. History and Government Regents Achievement (1993-1996), for North Tonawanda High School and Similar Schools
This School (————) Similar Schools (— — — —)

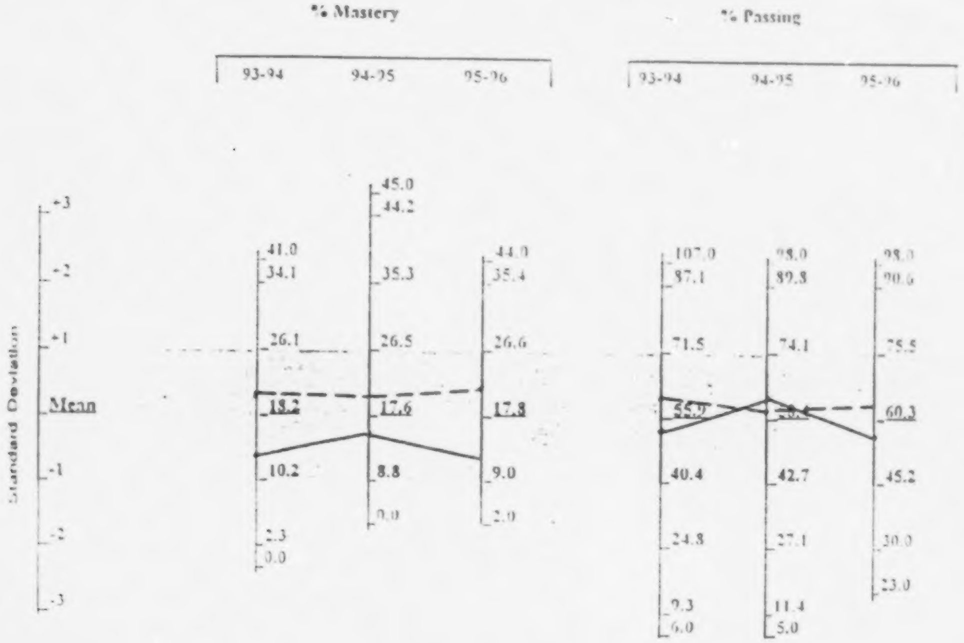

Figure 27. Achievement Chart X: Global Studies Regents Achievement (1993-1996), for North Tonawanda High School and Similar Schools

This School (————) Similar Schools (— — — —)

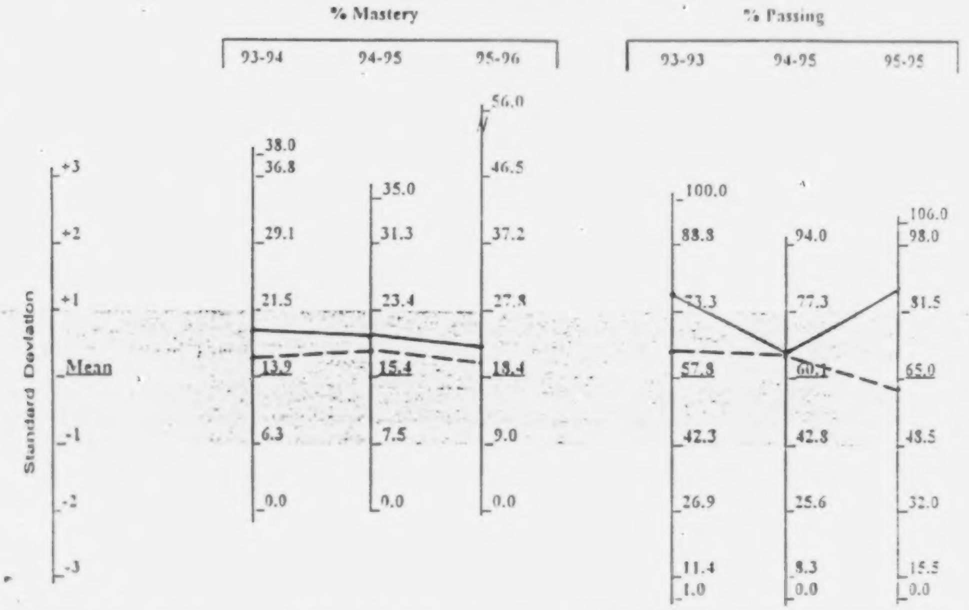

Figure 28. Achievement Chart XI: Languages Other than English Regents Achievement (1993-1996), for North Tonawanda High School and Similar Schools

This School (————) Similar Schools (— — — -)

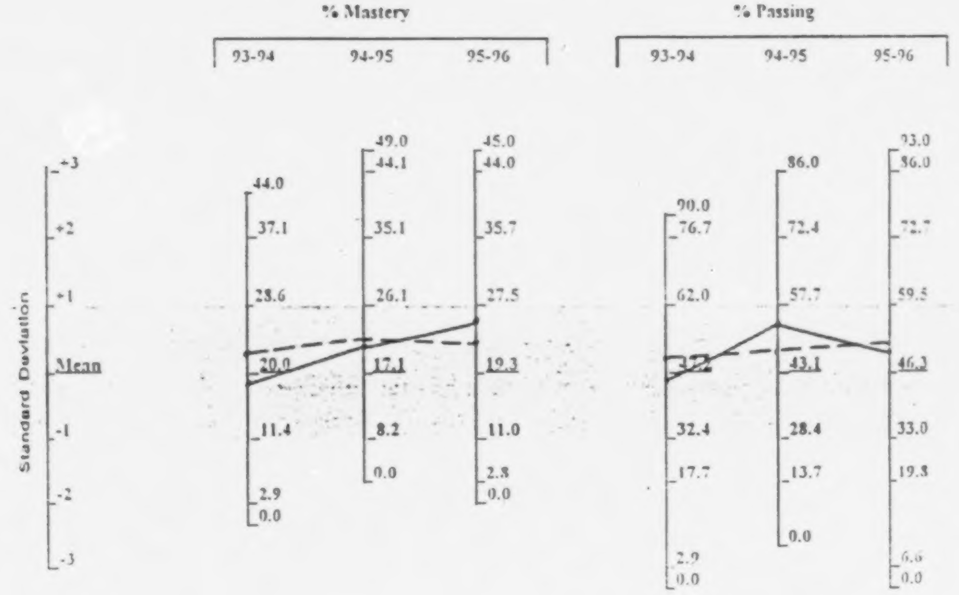

Figure 29. Achievement Chart XIIA: Percent Mastery of Mathematics I and III Regents Achievement (1993-1996), for North Tonawanda High School and Similar Schools

This School (————) Similar Schools (— — — -)

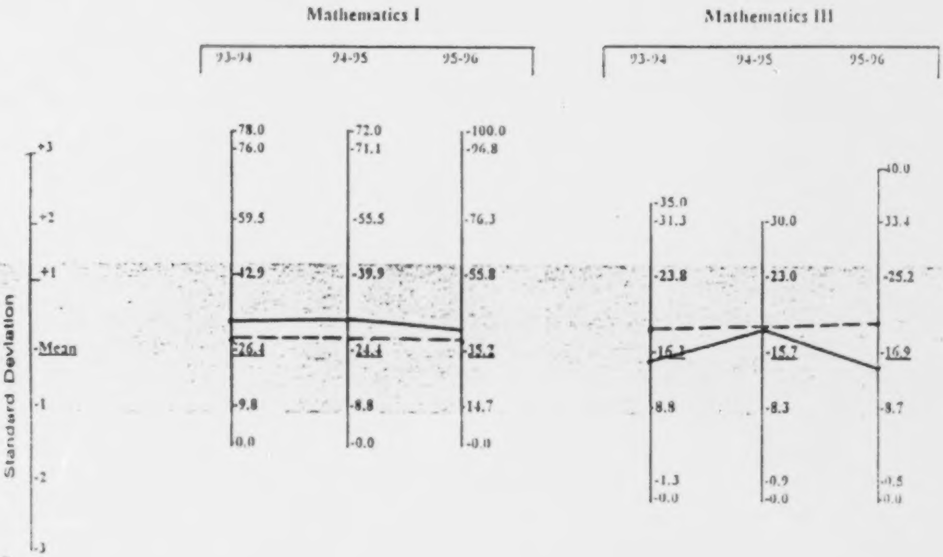

Figure 30. Achievement Chart XIIB: Percent Passing Mathematics I and III Regents Achievement (1993-1996), for North Tonawanda High School and Similar Schools

This School (————) Similar Schools (—— —— ——)

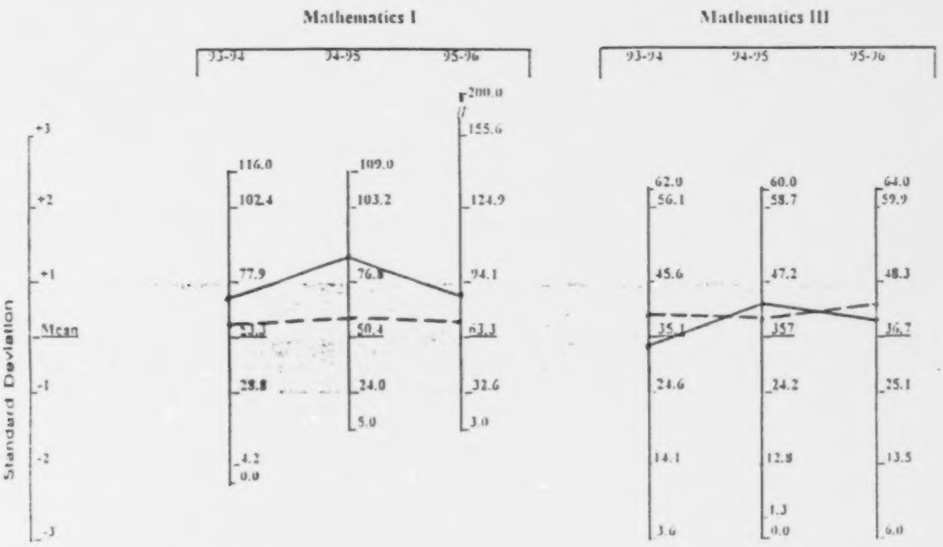

Figure 31. Achievement Chart XIII: Biology Regents Achievement (1993-1996), for North Tonawanda High School and Similar Schools

This School (————) Similar Schools (— — —)

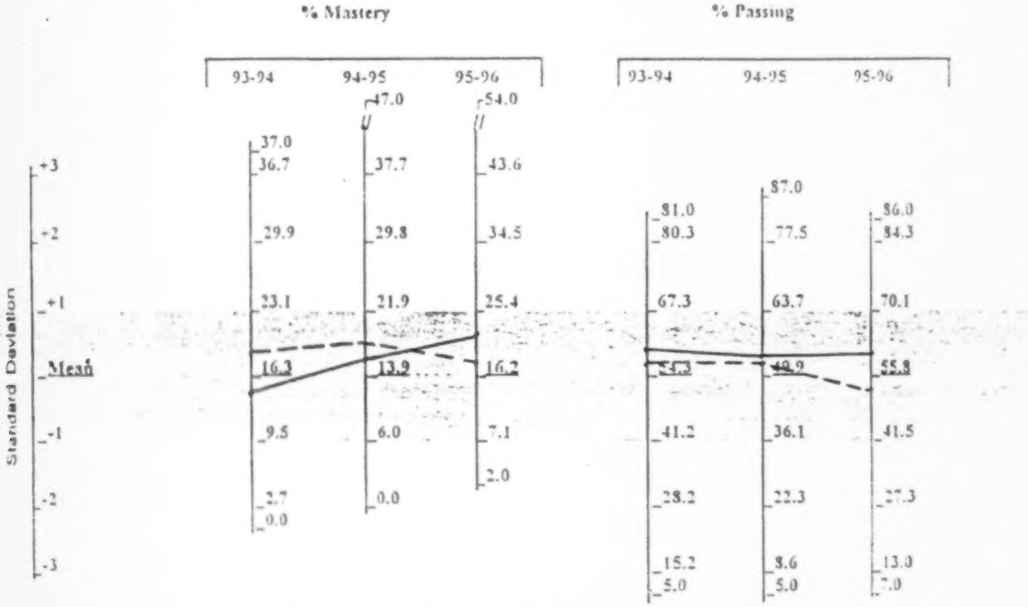

Figure 32. Achievement Chart XIV: Chemistry Regents Achievement (1993-1996), for North Tonawanda High School and Similar Schools

This School (————) Similar Schools (— — —)

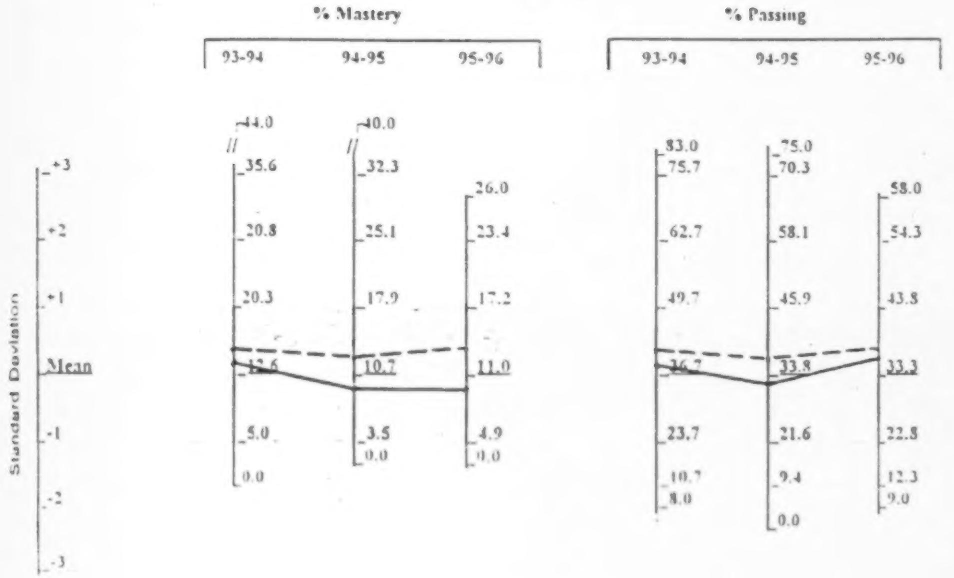

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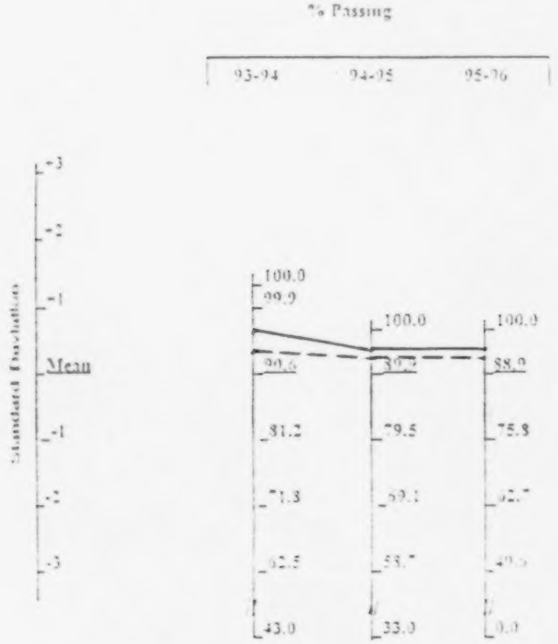
Figure 33. Achievement Chart XV. Introduction to Occupations Regents Achievement (1993-1996), for North Tonawanda High School and Similar Schools

This School (————) Similar Schools (— — —)



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case for the amounts at one standard deviation intervals above and below the mean. Expenditures shown in these charts have not been adjusted for variation in teacher costs within the region.

Six standard score charts have been developed to evaluate district fiscal policy:

- I. District Ability and Effort, 1995-96
- II. Revenue Source by Level of Government, 1995-96
- III. Sources of Local Revenue, 1995-96 ($ per EDNEED)
- IV. Type of State Aid, 1995-96 ($ per EDNEED)
- V. Expenditure Overview, 1995-96 ($ per EDNEED)
- VI. Expenditures for Instruction, 1995-96 ($ per EDNEED)

Plotting a school district's information on the standard score charts designed for assessing fiscal policy provides a visual profile of how the district's fiscal posture compares with other districts in the Western New York region. Financial data for all districts in the study except

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Buffalo may be obtained from *Financing Our Schools 1997*, published by Erie #1 BOCES[6]. For additional comparisons, reference districts can be plotted on the same chart. For illustrative purposes, the profiles for the Buffalo, Frontier and Williamsville school districts are presented in Figures 34-39. Buffalo and Williamsville are the region's two largest school districts and Frontier is the largest school district that consistently appears in the first quartile of efficiency on all efficiency models.

District Ability and Effort. Figure 34 shows the profiles for the three districts in reference to tax raising ability and effort. "Combined Wealth Ratio" is a statistic used in several state aid formulas. It reflects the wealth of a district in terms of both household personal income and the market valuation of real property per pupil wealth unit (TWPU). Williamsville ranks very high on this statistic, being more than two standard deviations above the mean for the region. Buffalo and Frontier, on the other hand, are in the middle range (the grey area), Buffalo being slightly below the mean for the region and Frontier slightly above. Buffalo and Frontier also hold similar positions for "Income/TWPU" and "Full Value/TWPU." Williamsville is above the middle range for both "Income/TWPU" and "Full Value/TWPU;" but, in relative terms, Williamsville is much wealthier in household personal income where it ranks among the top in the region than it is in real property valuation. The bar labeled "Tax Rate on Full Value" represents the effort that the taxpayers put forth in financially supporting their schools through the property tax. Williamsville's tax rate is in the middle range, slightly above average; Frontier's tax rate is also in the middle range, but slightly below the mean. Buffalo's tax rate for schools is one of the lowest in the region.

Revenue Source by Level of Government. Figure 35 shows the sources of revenue coming from local taxpayers and state and federal governments in support of the General Fund which represents virtually all of the expenditures made for instructional purposes for most districts. "Total Revenue/EDNEED" represents the total amount of revenue collected by the district in support of the General Fund per pupil adjusted for student need of special services (EDNEED) as explained previously. All three districts fall in the middle range on this statistic with Williamsville slightly above the mean for the region and Buffalo and Frontier below the mean. Buffalo and Frontier are in the middle range in both dollar amount per EDNEED and percent coming from local, state and federal levels; although, Buffalo's local revenue is nearly one standard deviation below the mean and its federal revenue is nearly one standard deviation above. Buffalo's state aid is slightly above average for the region and Frontier's is below. Williamsville's profile is a good illustration of both the state and the federal governments' "equalization" policies whereby priority is given to directing funds to districts with concentrations of poverty. Because of its wealth, even with only an average tax rate, Williamsville generates more local revenue per EDNEED than most other districts in the region; on the other hand, its state and federal support is among the lowest.

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[6] Alternatively, financial data for all districts in the study, including Buffalo, can be downloaded as Lotus or Excel spreadsheets from http://www.buffalo.edu/gse/fas/swanson/649. Click on "Readings and scroll down to item #6 and follow the instructions.

Figure 34 Profiles for Buffalo, Frontier and Williamsville School Districts for Finance Chart I District Ability and Effort, 1995-96

Buffalo (————) Frontier (—— - ——) Williamsville (-------------)

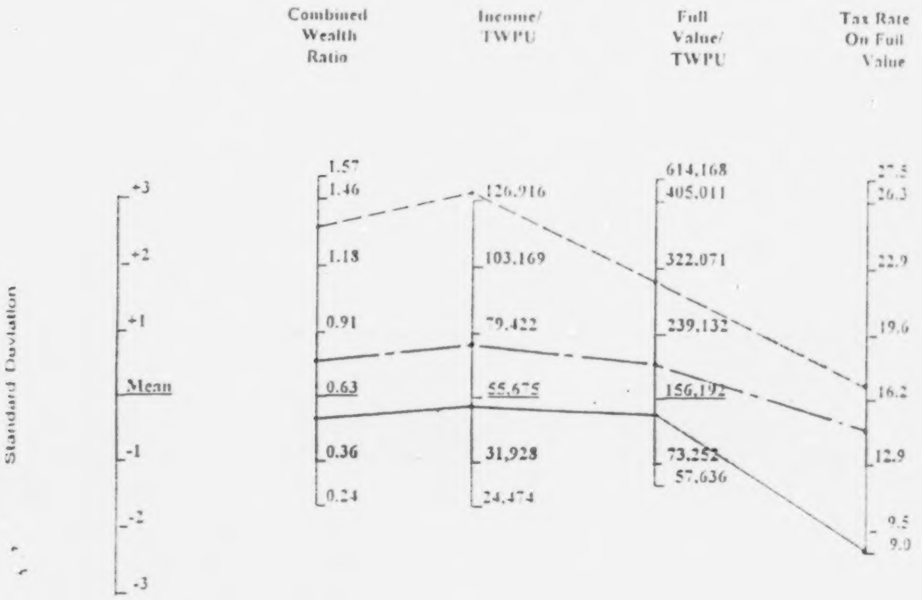


Figure 35 Profiles for Buffalo, Frontier and Williamsville School Districts for Finance Chart II: Revenue Source by Level of Government, 1995-96

Buffalo (————) Frontier (—— - ——) Williamsville (-------------)

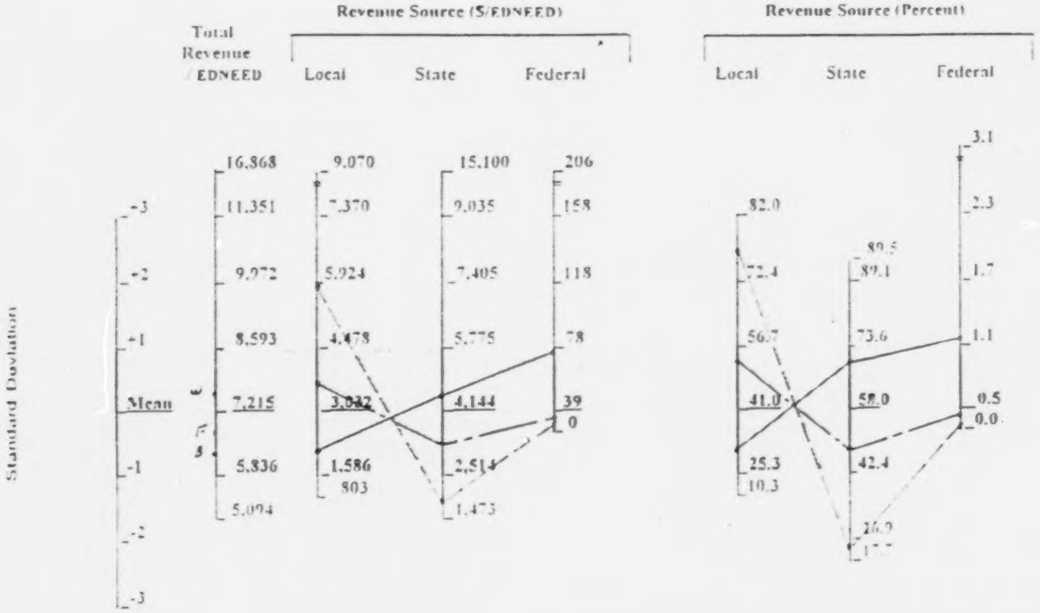


Figure 35 does not tell the whole story, however. While the General Fund contains nearly all of the instructional expenditures for most districts, some districts, especially those with high concentrations of pupils living in poverty like Buffalo, receive significant amounts of state and federal categorical aids that are accounted for in a Special Aid Fund. In the case of Buffalo, these Special Aid Fund revenues amounted to approximately $74,000,000 in addition to its General Fund Revenues of approximately $369,000,000 or 20%. Expenditures in 1995-96 from the Special Aid Fund amounted to approximately $78,000,000 in addition to its General Fund expenditures of approximately $364,000,000 or 21%. This has the effect of raising state aid as shown in Figure 8 from 64% to 69% and raising federal aid from 1% to 7.5%. The local share drops from 26% to 23%.

Sources of Local Revenue. Figure 36 shows the sources of local revenues per EDNEED for the General Fund. The districts are most widely dispersed on the amount of revenue raised through the property tax which reflects the distribution of Full Value per TWPU reported in Figure 34. All three districts are above the middle range for "Non-Property Tax" which is derived primarily, if not exclusively from the portion of the Erie County sales tax dedicated to schools. All Erie County schools will be high on this statistic because Erie County is the only county in the region to dedicate a portion of its sales tax in support of schools. Buffalo is low on the "Use of Money and Property" which is a function of the fact that Buffalo is fiscally dependent on the city government and returns on investments go directly to the city and not to the district. All three districts are low on "Miscellaneous" items. Frontier's revenue receipts are one standard deviation above the mean for "Charges for Services" and for "Sale of Property."

Types of State Aid. Figure 37 features the type of state aid received by districts. The high risk characteristics of Buffalo's school population is reflected in the relatively high amounts of state aid it gets for pupils with "Extraordinary Needs" and pupils with "Disabilities" in "Public" facilities. Buffalo's "Building" aid is among the lowest in the region. Buffalo's other state aid sources reported on the chart fall in the middle range, although "Transportation" is nearly one standard deviation above the mean. Except for "Gifted and Talented" aid, Williamsville's state assistance is below average for the region, and in three instances more than one standard deviation below the mean. Frontier's state aid profile hovers near, but below, the region's mean. Not included in the state aid reported in the figure is aid recorded in the Special Aid Fund, amounting to nearly $47,000,000 for Buffalo in 1995-96.

General Fund Expenditures. Figure 38 features a breakdown of expenditures from the General Fund per EDNEED by major categories. In terms of "Total General Fund" expenditures, the three districts spend near the mean for the region. Williamsville's expenditures for "Total Instruction" and "Plant & Maintenance" are more than one standard deviation above the mean. The rest of Williamsville's expenditures are near the mean. Buffalo's expenditures for "Plant and Maintenance," Employee Benefits" and "Transportation" are more than one standard deviation above the mean. Buffalo's other expenditures are in or near the middle range for the region. All of Frontier's expenditures fall into the middle range.

General Fund Expenditures for Instruction. Figure 39 enables a more detailed analysis

Figure 36 Profiles for Buffalo, Frontier and Williamsville School Districts for Finance Chart III Sources of Local Revenue ($ per EDNEED), 1995-96

Buffalo (————) Frontier (—— - ——) Williamsville (--------------)

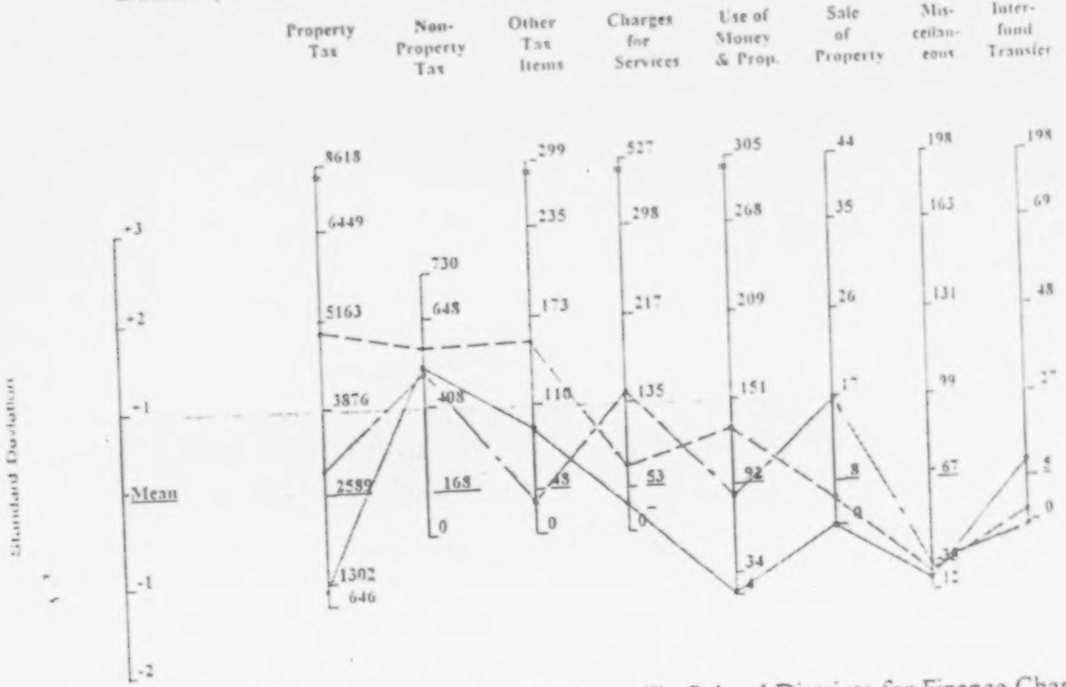


Figure 37 Profiles for Buffalo, Frontier and Williamsville School Districts for Finance Chart IV Types of State Aid ($ per EDNEED), 1995-96

Buffalo (————) Frontier (—— - ——) Williamsville (--------------)

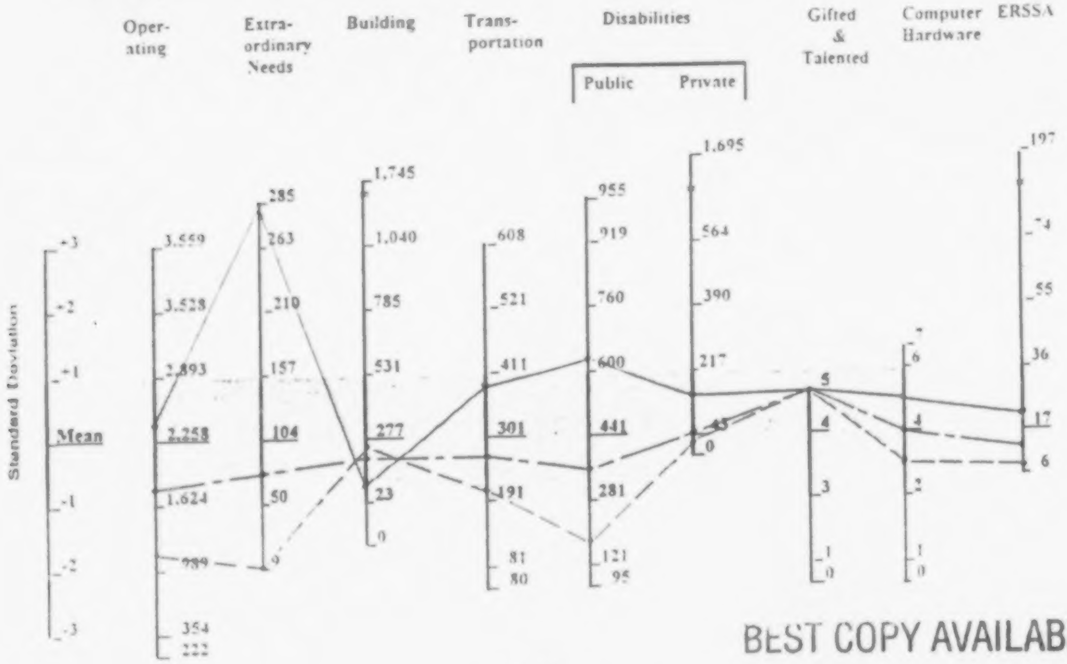


Figure 38 Profiles for Buffalo, Frontier and Williamsville School Districts for Finance Chart V Expenditure Overview, 1995-96 ($ per EDNEED)

Buffalo (————) Frontier (—— - ——) Williamsville (--------------)

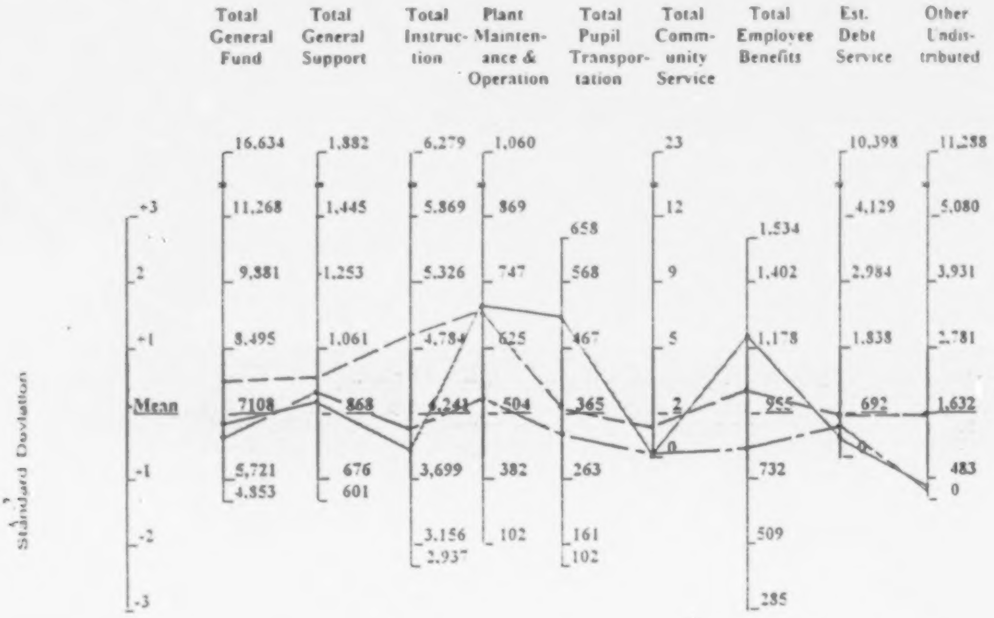
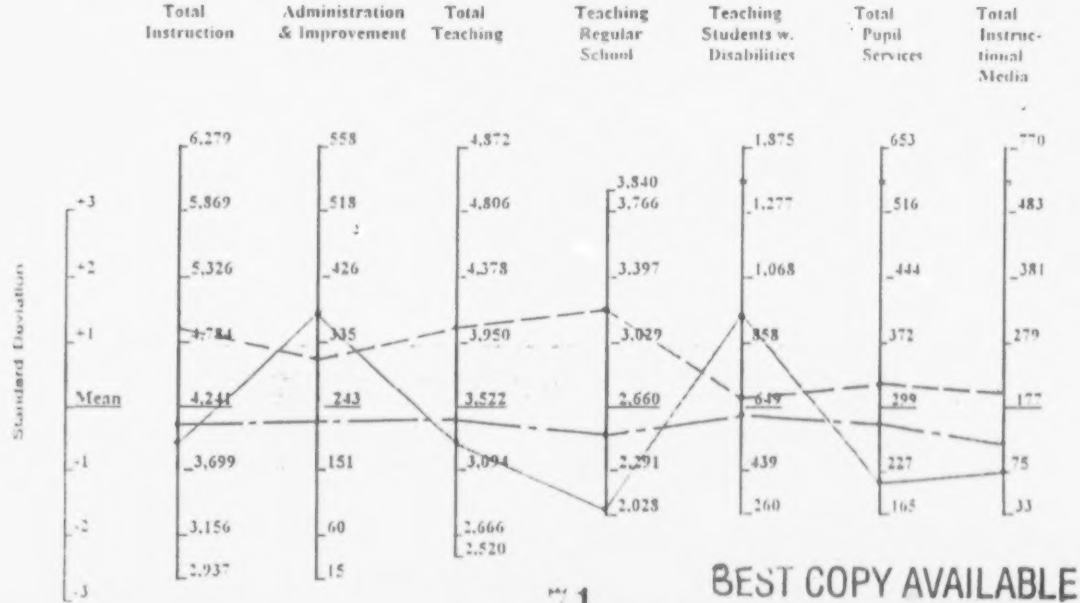


Figure 39 Profiles for Buffalo, Frontier and Williamsville School Districts for Finance Chart VI: Expenditures for Instruction, 1995-96 ($ per EDNEED)

Buffalo (————) Frontier (—— - ——) Williamsville (--------------)



of the major expenditure component of the General Fund, "Instruction." Frontier's expenditures for Instruction categories hover near, but below, the mean for the region. Buffalo spends more than one standard deviation above the mean for "Administration & Improvement" and "Teaching Students with Disabilities" and more than one standard deviation below the mean for "Teaching Regular School" and "Pupil Services." Williamsville's expenditures for "Total Teaching" and "Teaching Regular School" are more than one standard deviation above the mean; its other expenditures are above average, but in the middle range for the region.

Combined Expenditures from General Fund and Special Aid Fund. Expenditures made from the Special Aid Fund were not included in the finance charts because they are not available in the database used for the study. To illustrate the distortions that can be introduced into analysis of fiscal policy through the omission of expenditures made possible by the special aids, we obtained the Annual Financial Reports, New York State ST-3 Forms, for the two largest school districts in the region: Buffalo, which receives significant amounts of Special Fund Aid, and Williamsville, which receives relatively little as noted above. Figures 38 and 39 show Finance Charts V and VI, respectively, with the expenditure profiles for the two districts when expenditures from the Special Aid Fund are combined with those from the General Fund. For Williamsville, there is little change in the profiles; but, for Buffalo, the change is dramatic. In Figure 40, Finance Chart V, Buffalo's expenditures for "Total Instruction" rise from slightly below average for the region to one and one-half standard deviations above the mean and "Total Employee Benefits" rise to more than two standard deviations above the mean. With respect to the subcategories of "Total Instruction," reported in Figure 41, "Total Teaching" and "Teaching Regular School" join "Administration & Improvement" and "Teaching Students with Disabilities" at a level more than one standard deviation above the mean. Expenditures for "Total Pupil Services" and "Total Instructional Media" remain below average for the region.

Future Research

In many respects, the most difficult aspect of this research was the assembling of data bases from a number of sources. The work of Erie #1 BOCES in developing a data warehouse should make the assembling of databases almost routine, leaving more time for analysis and enabling annual reanalyses. Other regions and states should follow the Erie #1 example.

We are relatively satisfied with the performance of the student achievement and school effect measures although we still need to look for refinements. For example, the relationship between socio-economic status and pupil achievement may be curvilinear. If this is the case, we may have over corrected, thus understating the school effect of high socio-economic schools and districts. We did test for curvilinearity in this analysis and found the linear assumption to be reasonable. Never-the-less, the precise nature of the relationship should continue to be studied.

If these analyses were to be conducted annually, we would need to agree upon procedures and weights to allow for stability of measures from year to year. To establish weights for calculating school effect on a continuing basis, the regression equations for several years need to be studied. The averaging procedure used in developing the student achievement measures at

Figure 40. Profiles for Buffalo and Williamsville School Districts for Finance Chart V: Expenditure Overview, 1995-96 ($ per EDNEED)
(with General Fund and Special Aid Fund expenditures combined)
Buffalo (——————) Williamsville (--------------)

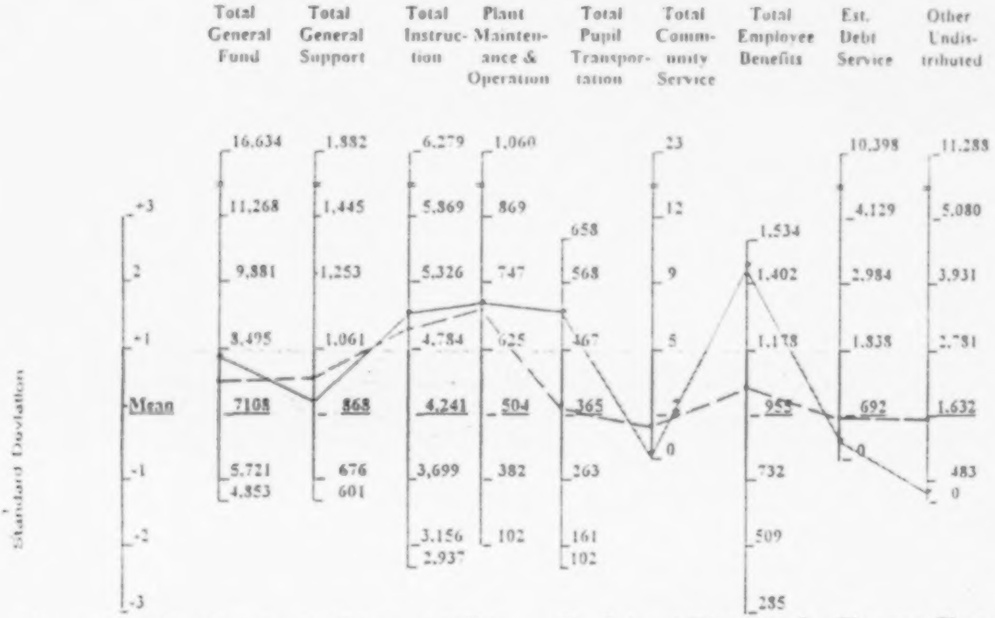
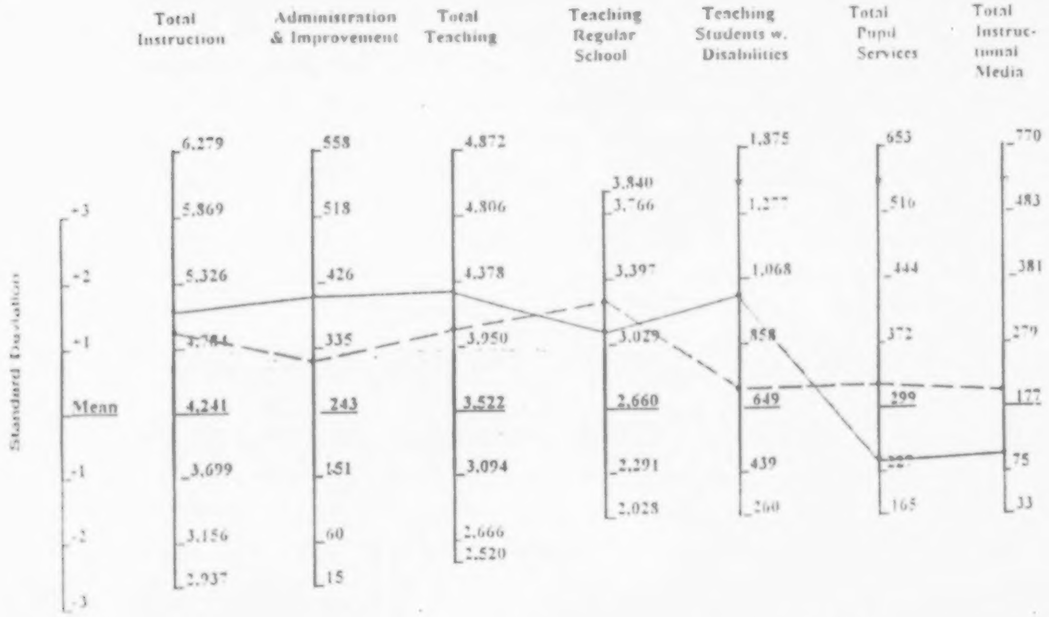


Figure 41. Profiles for Buffalo and Williamsville School Districts for Finance Chart VI: Expenditures for Instruction, 1995-96 ($ per EDNEED)
(with General Fund and Special Aid Fund expenditures combined)
Buffalo (——————) Williamsville (---------------)



the school level worked quite well and may be preferable to the factor analysis procedure used for district student achievement scores because the methodology is more easily understood by persons not having an extensive background in statistical methods.

It would be interesting to use Hierarchal Linear Modeling (HLM) to determine the nested effects of varying levels of efficiency for schools of the same level for the same district. This might provide insight as to why Buffalo, for example, has such a skewed distribution of efficiency scores among its elementary schools.

We are also convinced that financial data need to be adjusted for within region cost differences. In future analyses, these adjustments should be applied to the financial charts as well as to the efficiency analyses. A Cost of Education Index (CEI) is in the process of being developed by the National Center for Education Statistics that includes all costs, not just those for teaches (Chambers, 1998). When CEI indices are available at the district or county levels, they should be used instead of the Teacher Cost Index as was used in this analysis.

The EDNEED measure worked well in accounting for the differences in level of educational services required by children with different characteristics. While EDNEED reflects current New York State policy, it should be monitored in future applications to assess continuing satisfactory performance because a number of other studies suggest that it may be too conservative. Also, the "TAPU for Expense" measure used in calculating some state aids should be evaluated as a substitute for EDNEED. "TAPU for Expense" was not available in the database used for the study; but, if the two measures prove to be comparable, one that is widely used and understood is preferable to a new measure.

In preparing the finance charts, expenditures from the Special Aid Fund should be included in the reporting. Most federal aids are placed in this fund rather than the General Fund as are some state aids. Where these aids are large, a false picture of a district's fiscal profiles is presented when the services purchased with them are not included among the district's expenditures. All statistical analyses and charts need to be redesigned as better information becomes available. An advisory committee of persons using the analyses in making school district policies should participate in the redesign process.

The most innovative portion of the study is the efficiency analysis. The quadriform and ratio approaches are easily understood and can be applied immediately in analyzing school district fiscal policy. The DEA analyses have great potential for identifying fiscal slack in a school district; but it needs further development before it can be applied with confidence.

Despite our lack of full confidence in our efficiency measures, a dozen districts (both rural and suburban) have been identified as being consistently more efficient in the use of resources than the other districts. A next step is to carefully study these districts to find out what they are doing that permits them to achieve above average school effect with only a modest application of resources. Findings could be helpful to other school districts in making their operations more cost-effective. Enabling this type of research was the ultimate objective of the present research.

Conclusions

The information generally available for making school district comparisons has left much of the story untold. Some of the analyses that have been done and published by the mass media may serve a symbolic purpose, but they are of little strategic value in helping people to make beneficial changes in our educational systems. This study has added two dimensions, school district effect and school district efficiency, to the one normally considered, student achievement. In the process, we have highlighted the differences in challenges that school districts face. When more dimensions are considered, it is readily apparent that many school districts, not normally recognized for their effectiveness, are making important contributions to the intellectual development of their students. The contribution of other districts commonly recognized as outstanding are put into perspective. This does not, however, relieve schools and districts that have high school effects but whose students are still failing to meet established achievement standards of the responsibility for bringing those students up to standard; it just further illustrates the magnitude of the task. This study has shown that more spending on education is not the sole means to better results; money has to be spent *wisely* in order to achieve the results desired. This is where the concept of efficiency becomes very important.

To assist in the difficult task of assessing school district fiscal policy, we have developed a series of charts to facilitate the process of benchmarking through making external comparisons. We have also developed a series of achievement charts that enable schools to visualize their actual contribution to student achievement and to make comparisons of student achievement with selected reference groups.

Considerable sophistication has been developed in measuring the equity of resource allocation among and within school districts. As public concern over efficiency of school operations grows, more sophistication needs to be gained in defining and measuring that concept. We hope that this exercise has contributed to the general understanding of the forces contributing to student achievement, to analyzing efficiency of school operations, and to the need for further research on the topic.

Further, if an assessment is made that these statistics and charts are useful to school policy makers and to the general public in better understanding the decisions that have to be made, and in ultimately making better decisions, then judgements need to be made as to whether this type of analysis should be continued on a regular basis and how.

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Glossary of Terms as Used in this Report

Accountability. Public school officials being held responsible (answerable) for their fiscal performance and for the performance of the pupils in their charge.

Achievement, Student. An aggregate measure of student academic performance made up of all state required tests given at grades 3, 4, 5, 6 and 8 and the per cent passing and per cent scoring at the mastery level or above on all Regents examinations.

Benchmarking. Comparing current performance with a point of reference such as performance at a previous time for an organization or against the current performance of similar organizations; is a form of assessment that establishes external standards to which internal processes may be compared.

Data Envelopment Analysis (DEA). Uses linear programming concepts to determine the efficiency of an organization in using resources in terms of outcomes received by adjusting data to prescribed theoretical requirements such as optimal production surfaces prior to undertaking various statistical tests.

Educational Need Measure (EDNEED). An adjustment to pupil enrollment or attendance in a school or a district that takes into account the differences in costs of educational programs required to meet the instructional needs of children with varying characteristics, for example, special education and gifted students.

Effect, District. A derived score that attempts to measure the influence of the educational experiences provided by a school district that are independent of peer and home influences.

Effect, School. A derived score that attempts to measure the influence of the educational experiences provided by a school that are independent of peer and home influences.

Effectiveness. The degree to which a school's or district's educational goals and objectives are realized.

Efficiency. The ratio of outcomes (e.g., school effect) to inputs (e.g., dollars per pupil in expenditure or professional personnel employed).

Efficiency, Economic. The ratio of outcomes (e.g., school effect) to inputs measured in terms of cost of resources consumed.

Efficiency, Technical. The ratio of outcomes (e.g., school effect) to inputs measured in terms of the amount of resources consumed independent of their cost.

Factor Analysis. A statistical procedure that identifies groups of variables that are highly correlated with one another.

General Fund. The accounting fund in which virtually all operating expenditures are placed by most school districts.

Multiple-regression. A statistical relationship between a single dependent variable (effect, e.g., student achievement) and a combination of two or more independent variables (cause, e.g., pupil-teacher ratio).

Normal Curve. A symmetrical, bell shaped curve that describes the distributions of many random (chance) events.

Normal Distribution. A distribution bounded by a normal curve wherein approximately two thirds of the cases fall between the two points of the curve's inflexion.

Outlier. A school or district that is characterized by being more than one standard deviation above or below the mean of a group of schools or districts (a distribution) on a trait (e.g., expenditure per pupil).

Production Function, Educational. The causal relationship between inputs and outputs, e.g., what goes on in schools and classrooms that directly affects the minds of students as measured by tests and other outcome measures.

Production Possibility Frontier. The curve representing the most efficient use of a combination of resources.

Quadriform Analysis. A procedure whereby schools or districts are grouped into quadrants according to the achievement of their pupils and the level of their resource commitment per pupil and the characteristics of the schools or districts within each quadrant are compared with those in other quadrants.

Ratio Analysis. The ratio of a measure of school or district outcomes (e.g., school effect) to a measure of school or district inputs (e.g., expenditure per pupil).

Raw Score. An unadjusted measure.

Regression Analysis. A statistical relationship between a single dependent variable (effect, e.g., student achievement) and a single independent variable (cause, e.g., pupil-teacher ratio).

Residual Score. A measure (e.g., school effect) of the magnitude of a dependent variable (e.g., student achievement) that is not related to (or caused by) an independent variable (e.g., socio-economic status).

School District Ability. A measure of a school district's wealth or ability to financially support its educational endeavors (e.g., combined wealth ratio, market value of real property per pupil, household income per pupil).

School District Effort. The proportion of its resources a school district uses in support of its educational enterprises (e.g., tax rate on full value).

Skewed. A distribution whose shape is not symmetrical.

Socio-economic Status. The level of social esteem or affluence of an individual or family often measured by level of education or household income.

Special Aids Fund. An accounting fund from which restricted revenues from state and federal governments are spent.

Standard Deviation. A measure of variability whereby approximately two thirds of the cases of a distribution fall within one standard deviation of the mean (plus and minus) and 95 per cent of the cases will be within two standard deviations of the mean.

Standard Score. A derived score that enables comparisons among several characteristics by providing the characteristics a common metric, their respective standard deviation, and a common mean, zero.

Standards. A set of achievement expectation established by a state, school district, individual, etc.

Teacher Cost Index. A ratio that adjusts for the variation in cost of teachers among school districts due to factors beyond their control such as cost of living, desirability of the community, etc.

Appendix A

Standard Score Charts
of
Selected Financial Statistics
for School Districts in the
Western New York Region

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I. District Ability and Effort, 1995-96

II. Revenue Source by Level of Government, 1995-96

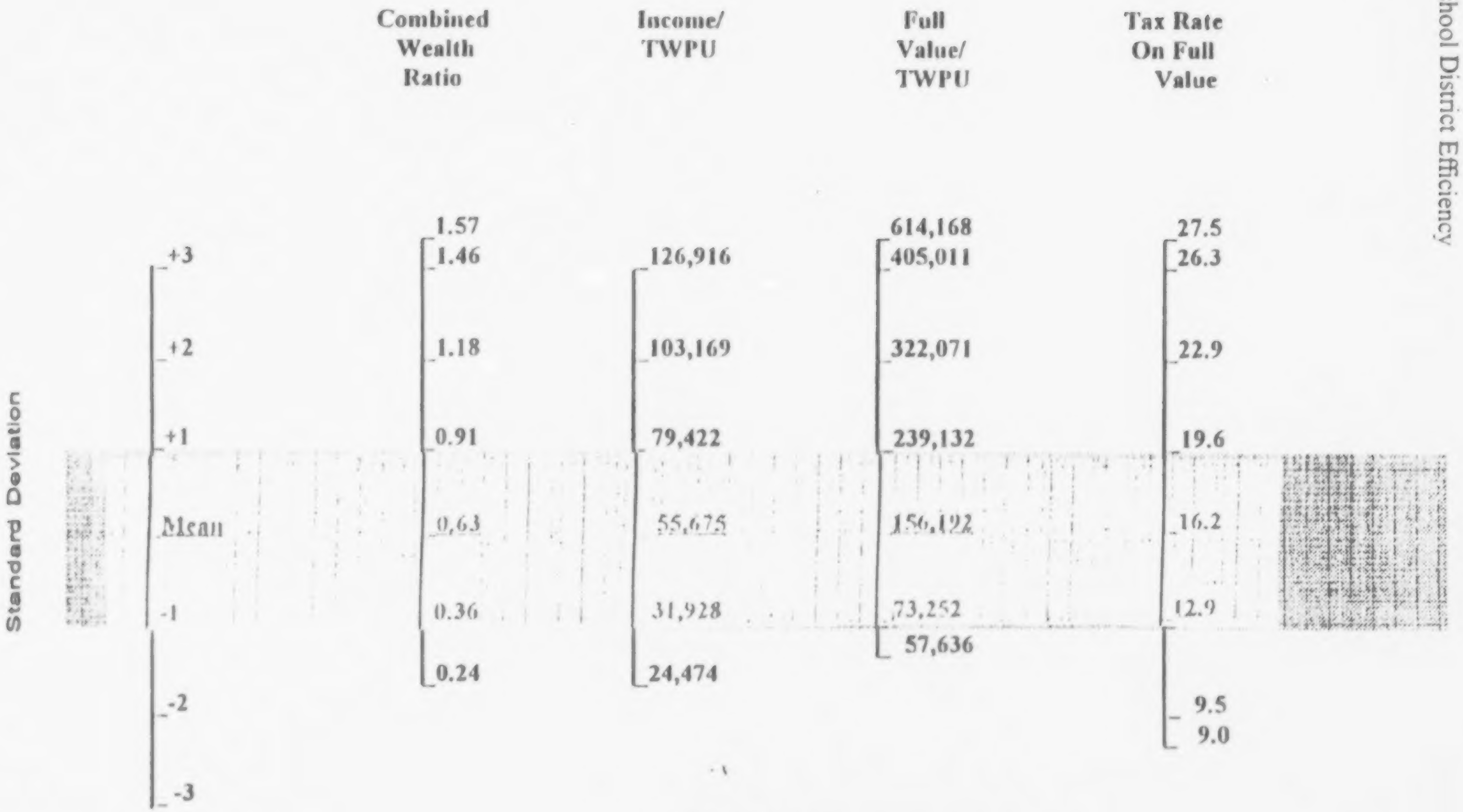
III. Sources of Local Revenue, 1995-96 ($ per EDNEED)

IV. Type of State Aid, 1995-96 ($ per EDNEED)

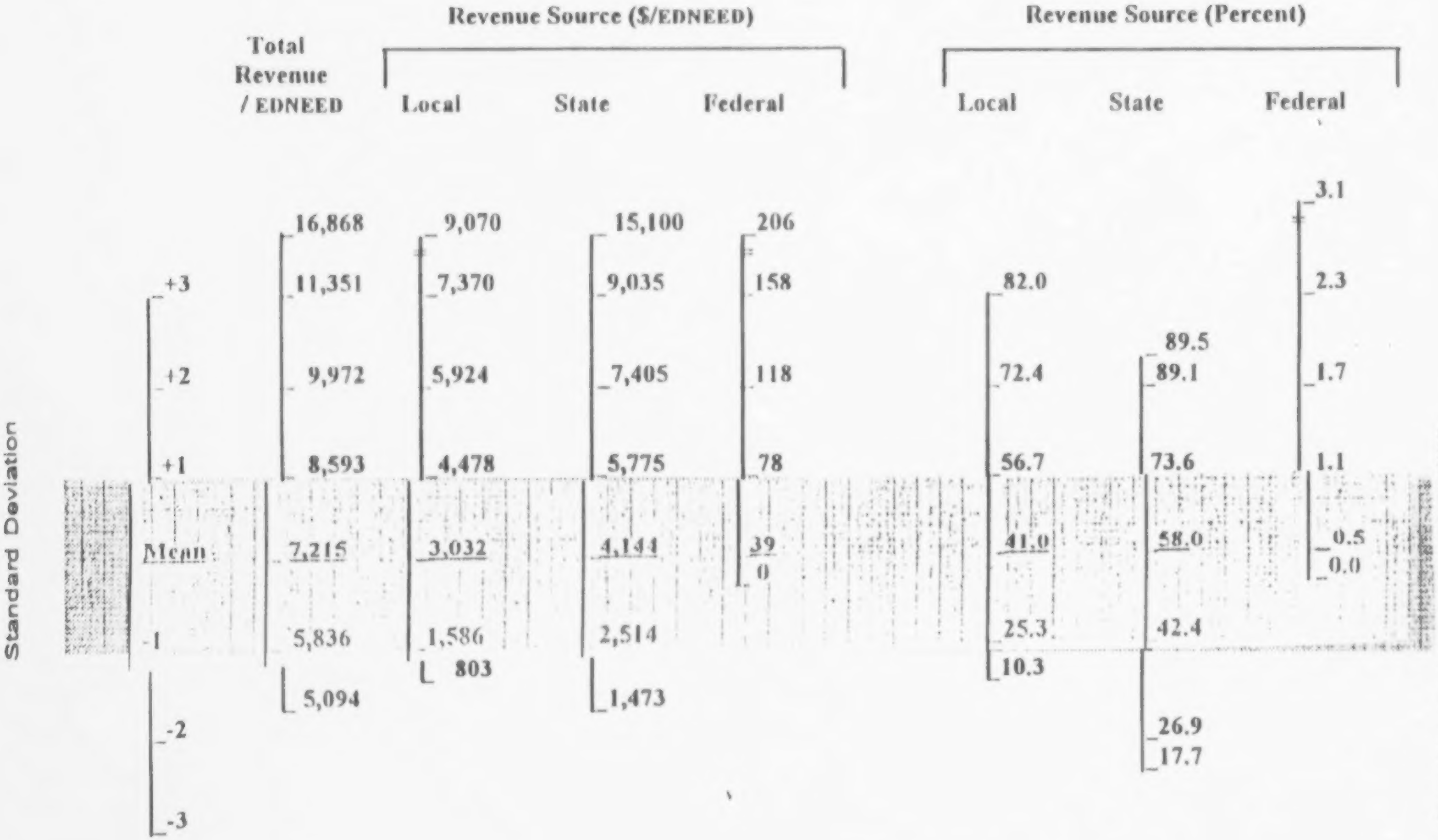
V. Expenditure Overview, 1995-96 ($ per EDNEED)

VI. Expenditures for Instruction, 1995-96 ($ per EDNEED)

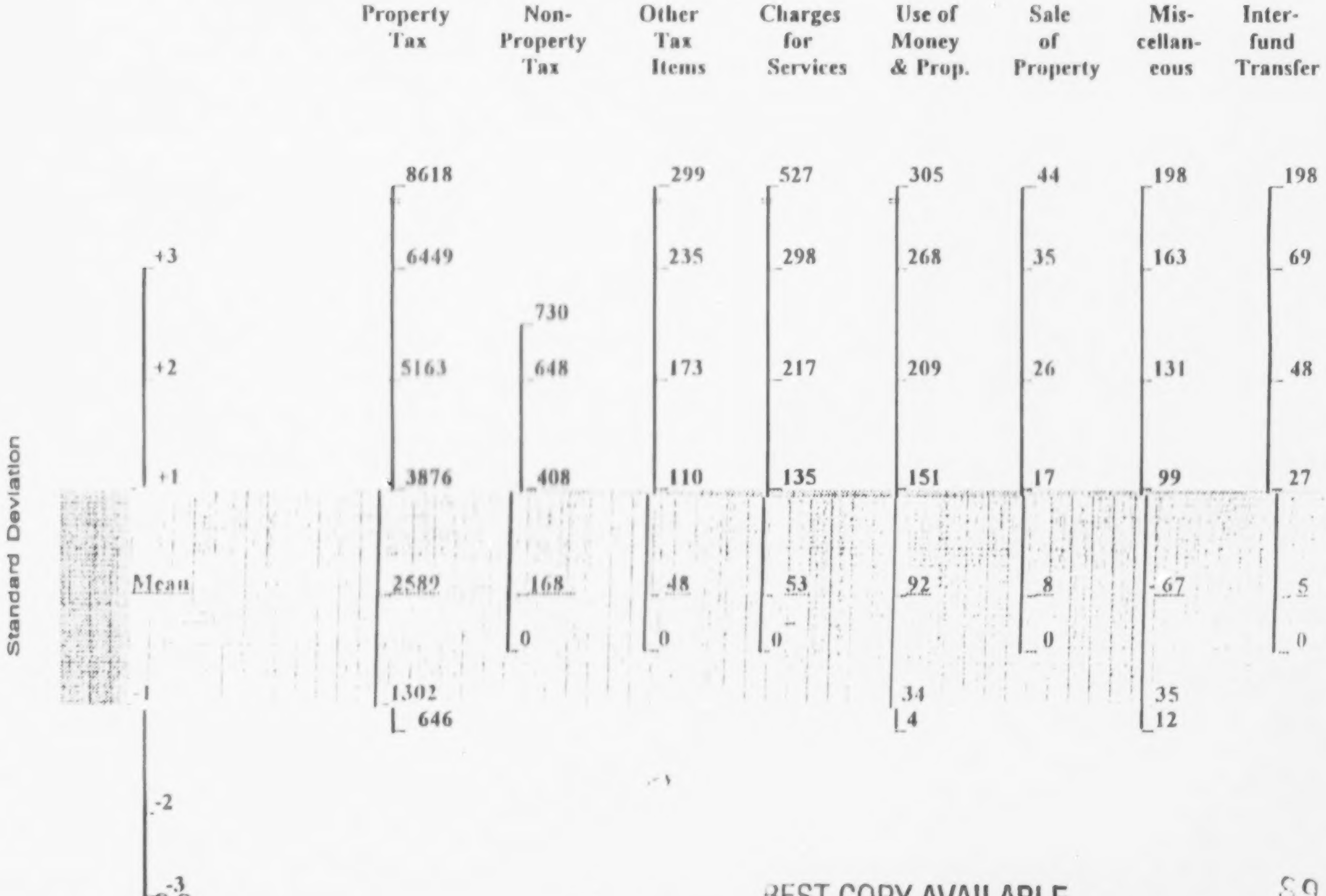
Finance Chart I. District Ability and Effort, 1995-96



Finance Chart II. Revenue Source by Level of Government, 1995-96



Finance Chart III. Sources of Local Revenue ($/EDNEED), 1995-96



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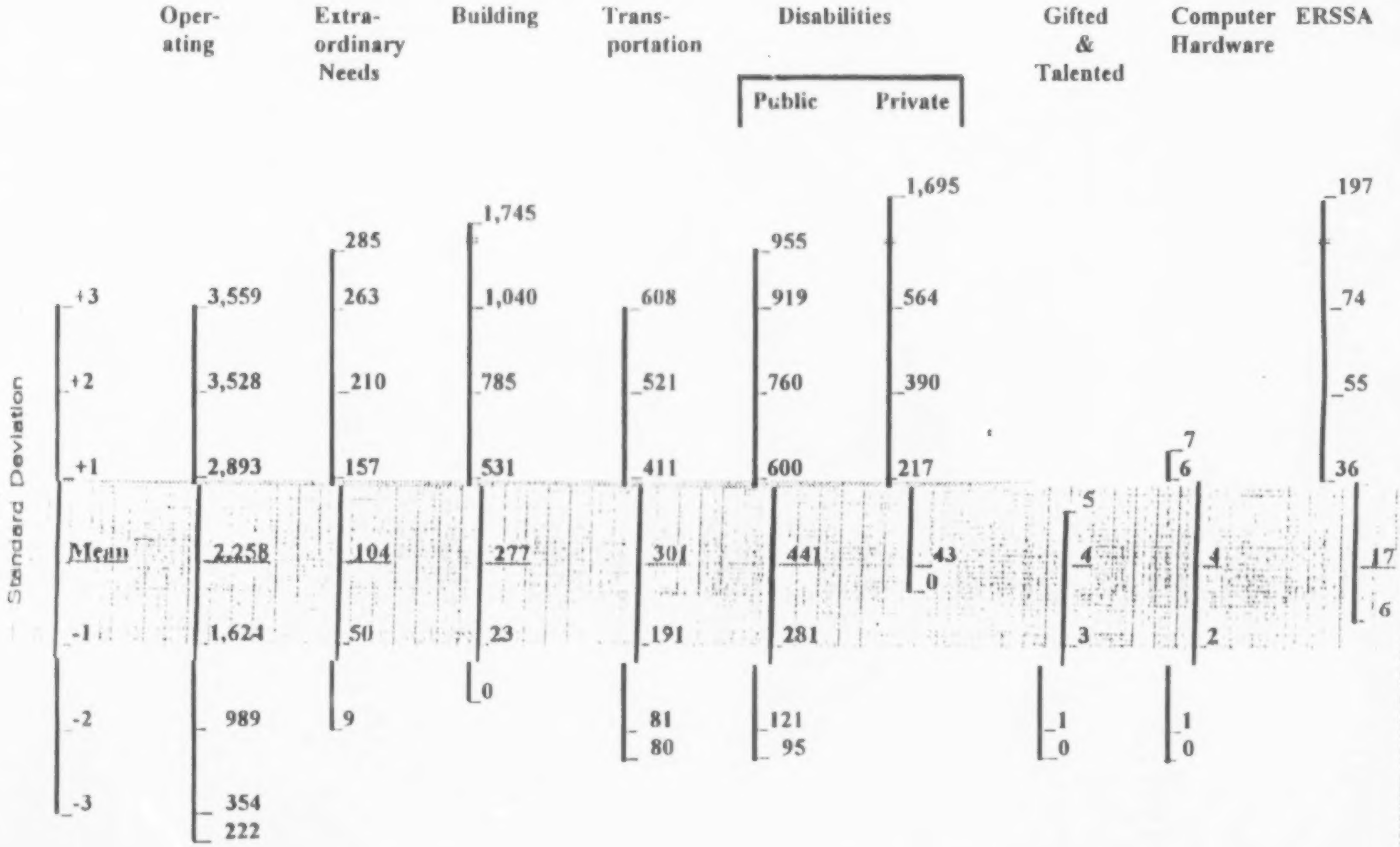
Finance Chart IV: State Aid by type, 1995-96 ($ per EDNEED)



Finance Table V. Expenditure Overview (Per EDNEED), 1965-66

Standard Deviation	Total General Fund	Total General Support	Total Instruction	Plant Maintenance & Operation	Total Pupil Transportation	Total Community Service	Total Employee Benefits	Est. Debt Service	Other Undistributed
	16,634	1,882	6,279	1,060		23		10,398	11,288
+3	11,268	1,445	5,869	869		12		4,129	5,080
					658		1,534		
2	9,881	1,253	5,326	747	568	9	1,402	2,984	3,931
+1	8,495	1,061	4,784	625	467	5	1,178	1,838	2,781
Mean	7108	868	4,241	504	365	2	955	692	1,632
						0		0	
-1	5,721	676	3,699	382	263		732		483
	4,853	601							0
-2			3,156	102	161		509		
			2,937		102				
-3							285		

Finance Chart VI: Expenditures for Instruction, 1995-96 ($ per EDNEED)

Standard Deviation	Total Instruction	Administration & Improvement	Total Teaching	Teaching Regular School	Teaching Students w. Disabilities	Total Pupil Services	Total Instructional Media
	6,279	558	4,872	3,840	1,875	653	770
+3	5,869	518	4,806	3,766	1,277	516	483
+2	5,326	426	4,378	3,397	1,068	444	381
+1	4,784	335	3,950	3,029	858	372	279
Mean	4,241	243	3,522	2,660	649	299	177
-1	3,699	151	3,094	2,291	439	227	75
				2,028	260	165	33
-2	3,156	60	2,666				
			2,520				
	2,937	15					
-3							

Appendix B

New York State

School Report Card

Standard Score Charts

Based on the average scores of schools

in the eight county region of Western New York

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I. Descriptive Information (1993-1996)

II. Performance Related Measures (1992-1995)

III. Grade 3 Reading & Mathematics Achievement (1993-1996)

IV. Grade 4 Science Achievement (1995-1996)

V. Grade 5 Writing Achievement (1993-1996)

VI. Grade 6 Reading, Mathematics & Social Studies Achievement (1993-1996)

VII. Grade 8 Social Studies Achievement (1995-1996)

VIII. English Regents Achievement (1993-1996)

IX. U. S. History & Government Regents Achievement (1993-1996)

X Global Studies Regents Achievement (1993-1996)

XI Languages Other Than English Regents Achievement (1993-1996)

XII Mathematics I & III Regents Achievement (1993-1996)

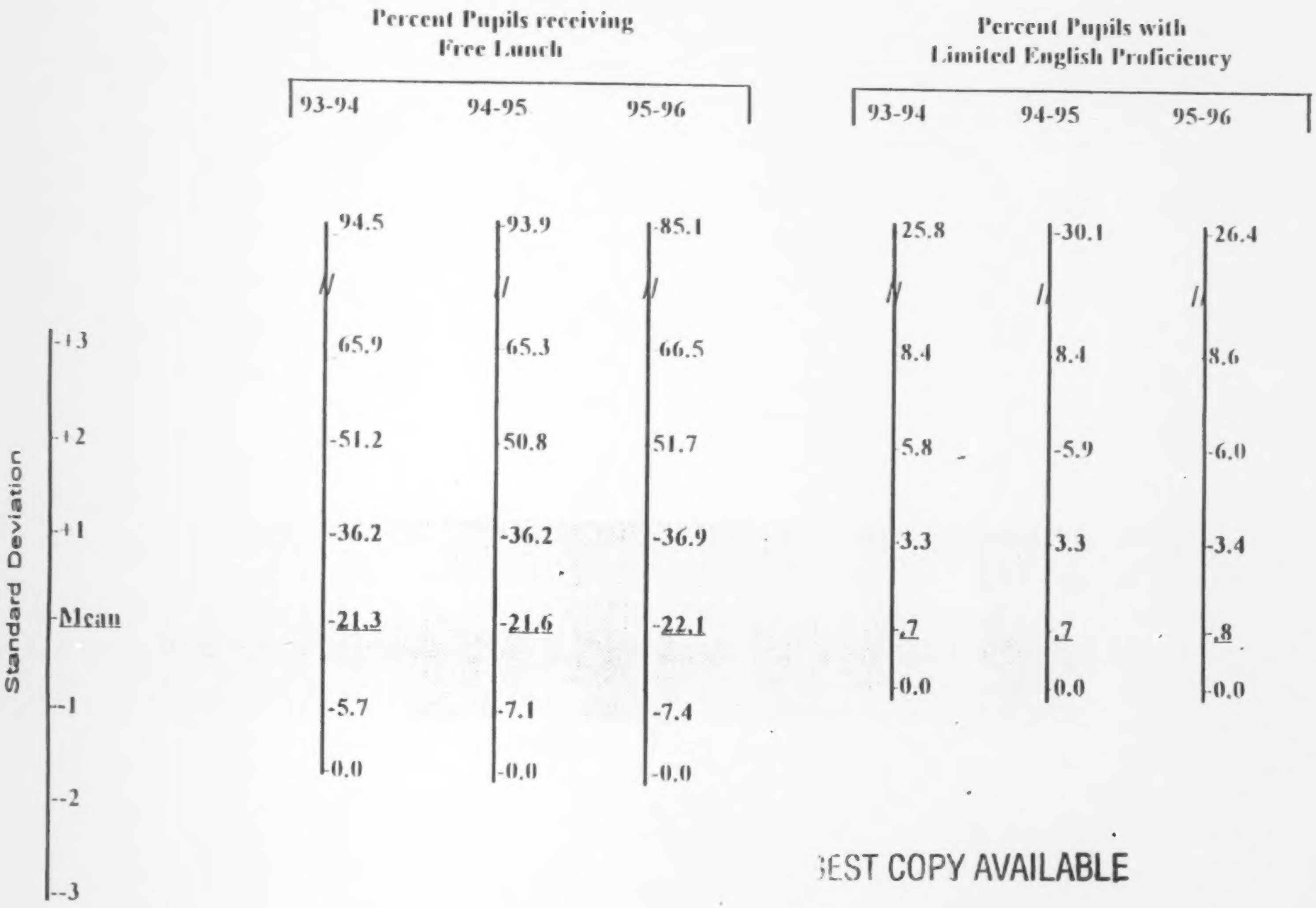
XIII Biology Regents Achievement (1993-1996)

XIV Chemistry Regents Achievement (1993-1996)

XV Introduction to Occupations Regents Achievement (1993-1996)

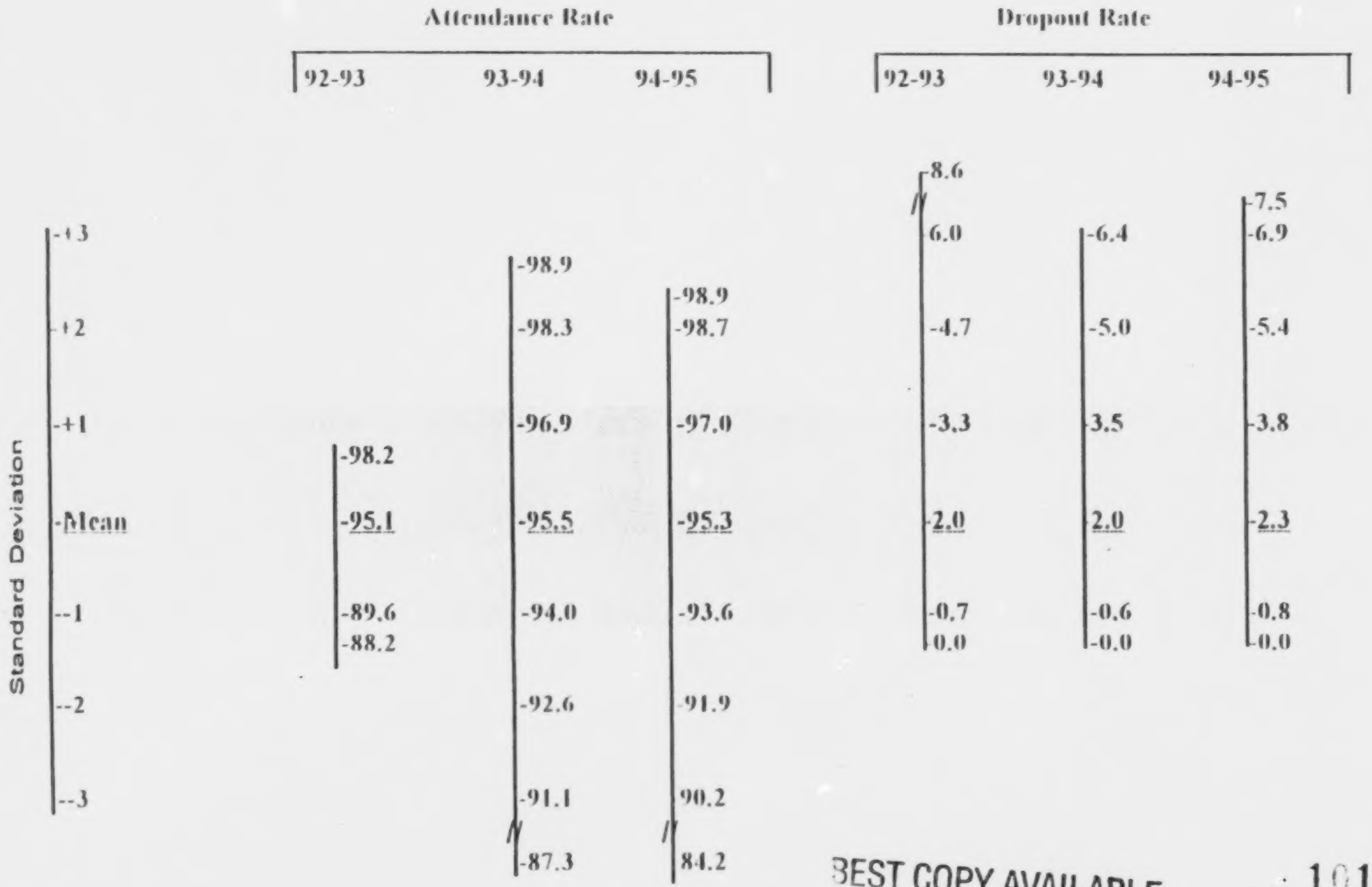
Achievement Chart I. **Descriptive Information (1993-1996)**

This School ———— This District —— - —— Similar Schools - — — — — — —



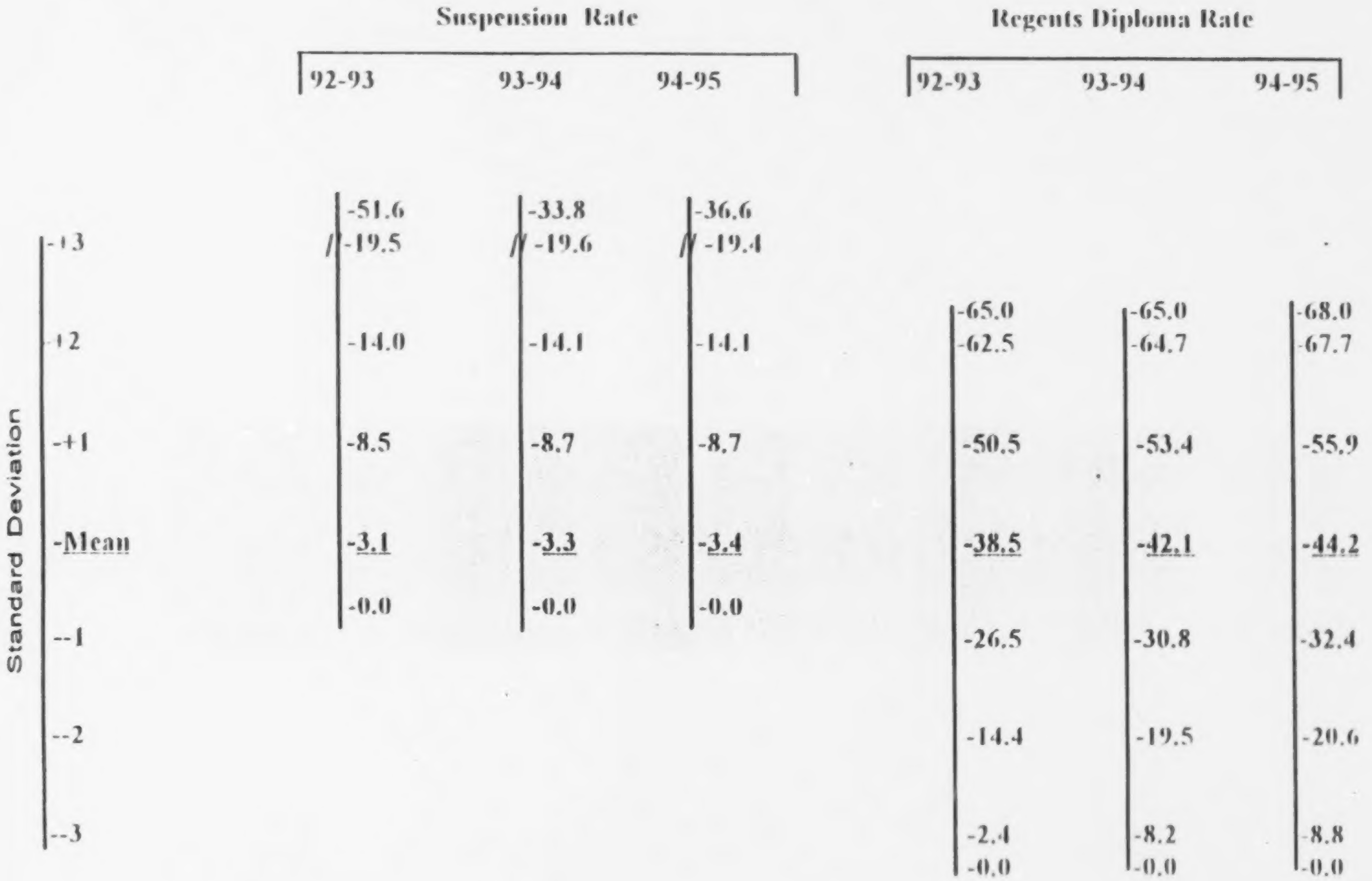
Achievement Chart IIA. Performance Related Measures (1992-1995)

This School ———— This District —— — — Similar Schools - - - - - - -



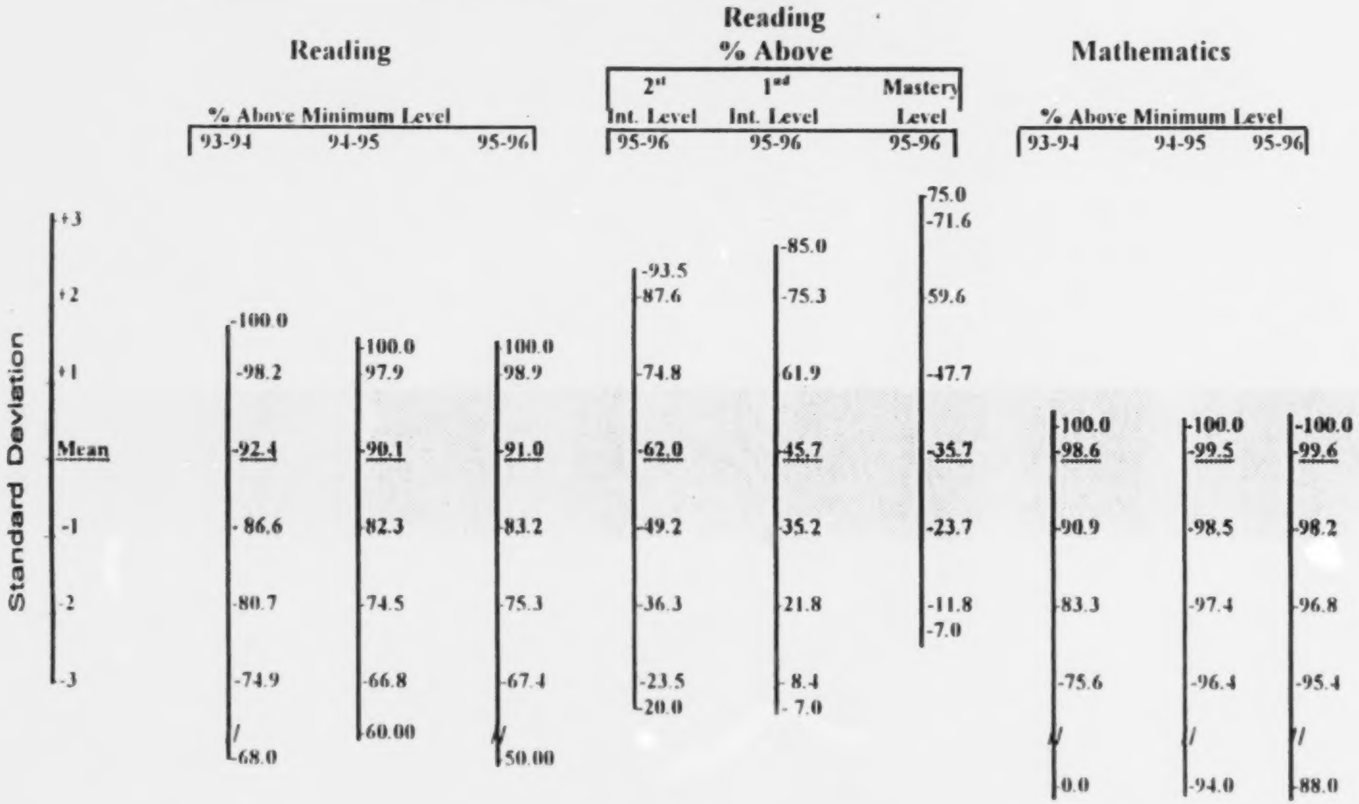
Achievement Chart IIB. Performance Related Measures (1992-1995)

This School———This District—— -— Similar Schools – – – – – –



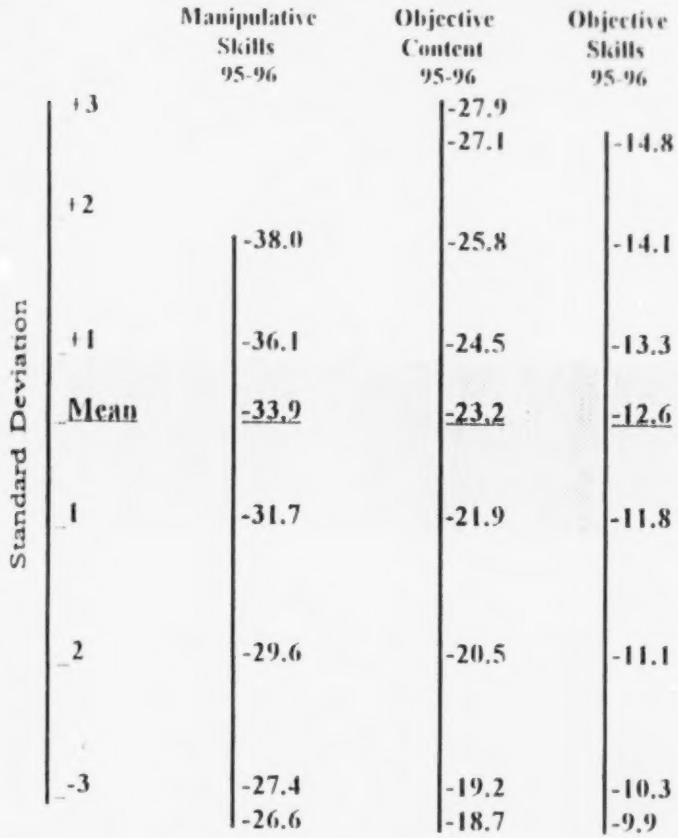
Achievement Chart III. Grade 3 Reading & Mathematics Achievement (1993-1996)

This School ———— This District — - — Similar Schools – – – – – –



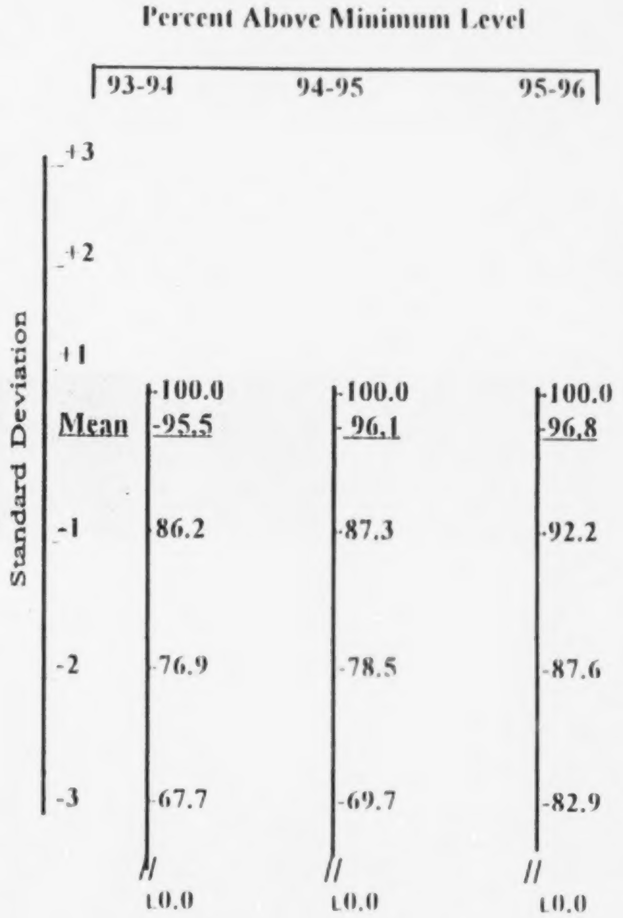
Achievement Chart IV. Grade 4 Science Achievement (1995-1996)

This School ———This District — - —Similar Schools - - - - -



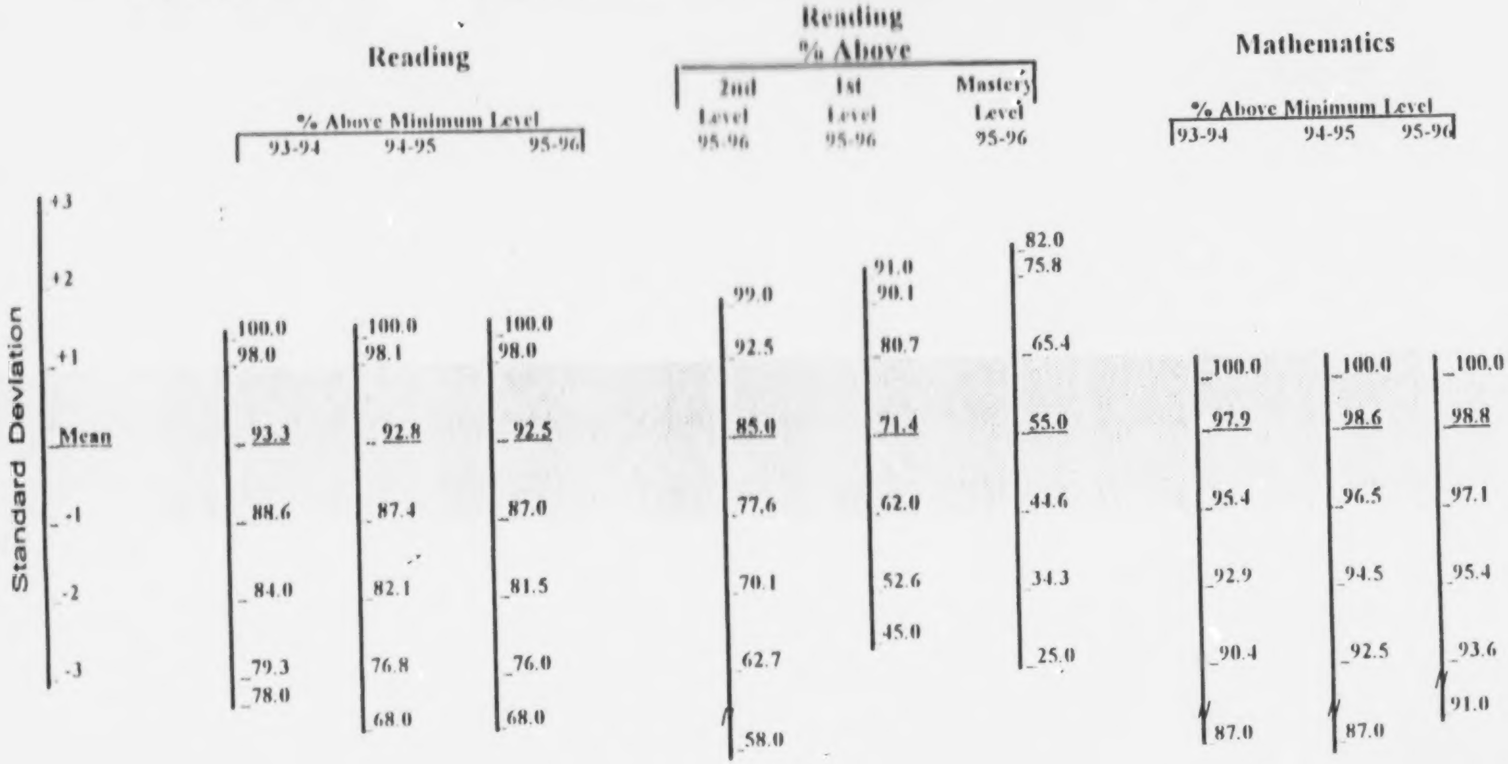
Achievement Chart V. Grade 5 Writing Achievement (1993-1996)

This School ———This District — · — Similar Schools - - - -



Achievement Chart VIA. Grade 6 Reading & Mathematics Achievement (1993-1996)

This School ———— This District — - — Similar Schools — — — — — —



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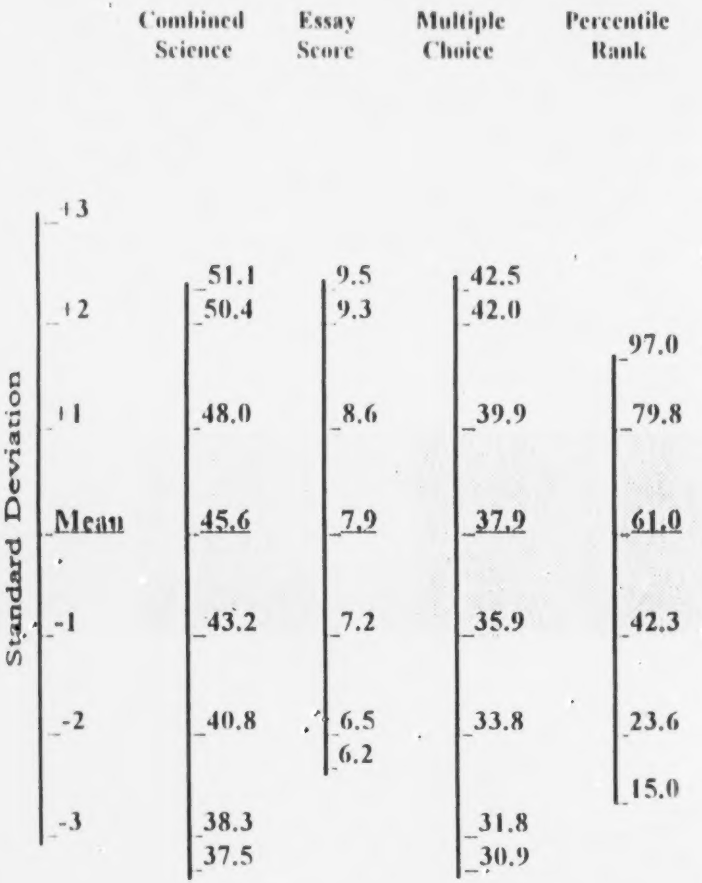
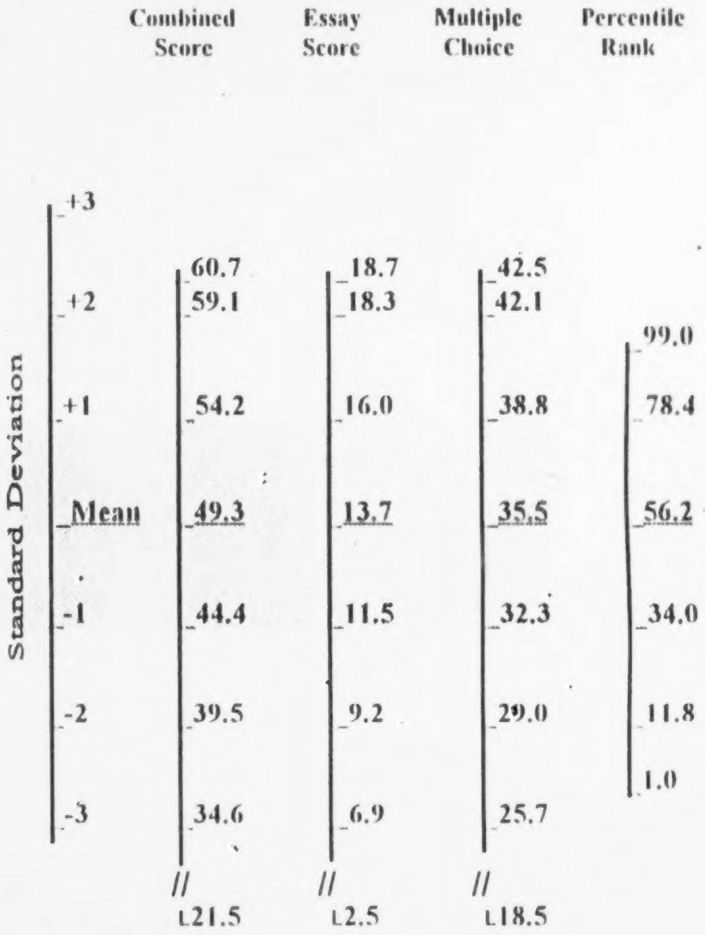
Achievement Chart VIB. Grade 6 Social Studies Achievement (1993-1996)
This School ———— This District —— - —— Similar Schools — — — —

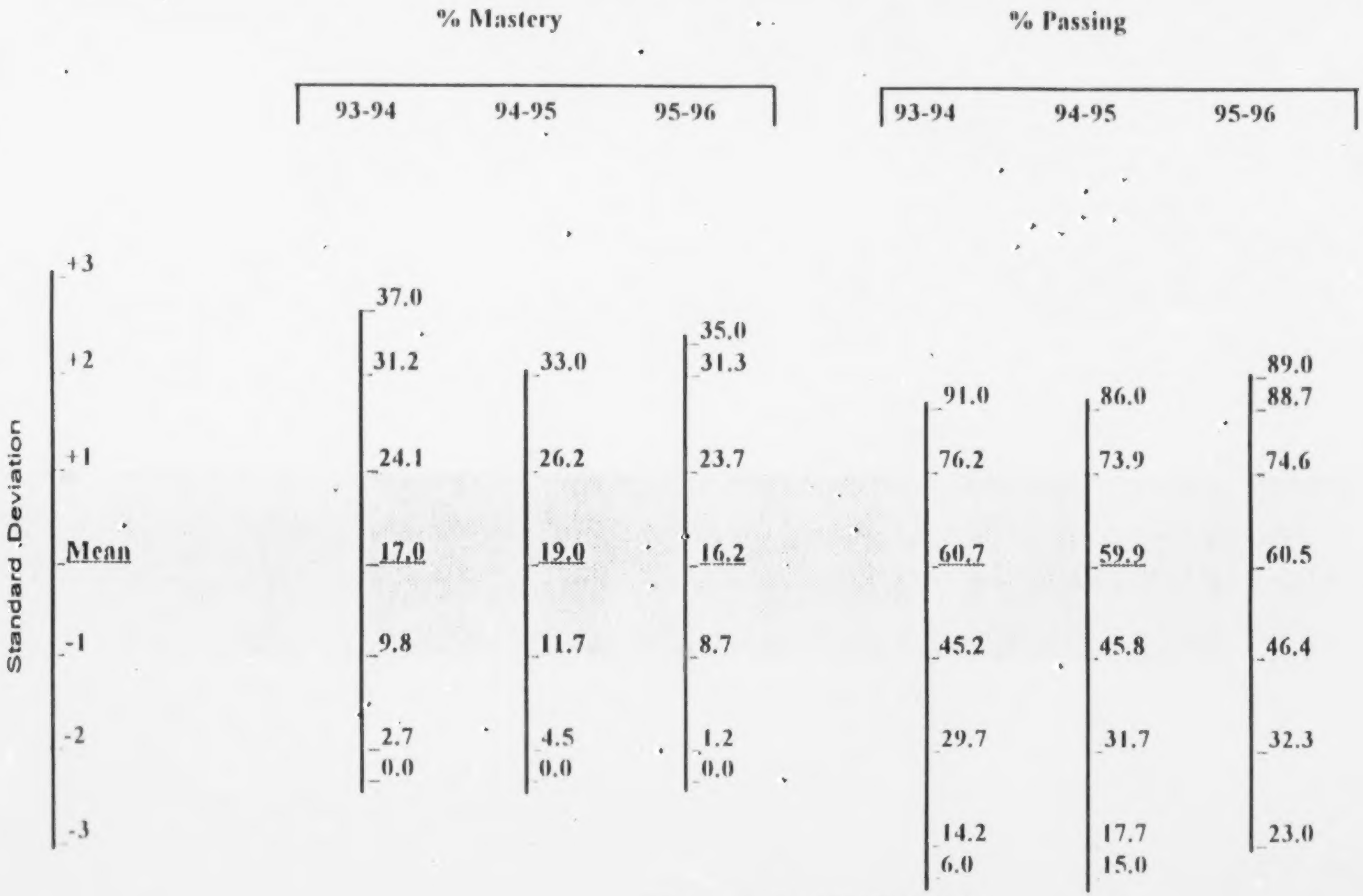


Achievement Chart VII. Grade 8 Social Studies Achievement (1995-1996)
This School ————This District —— - ——Similar Schools — — — —



Achievement Chart VIII. English Regents Achievement (1993-1996)

This School ——— This District — - —Similar Schools — - - - - - -



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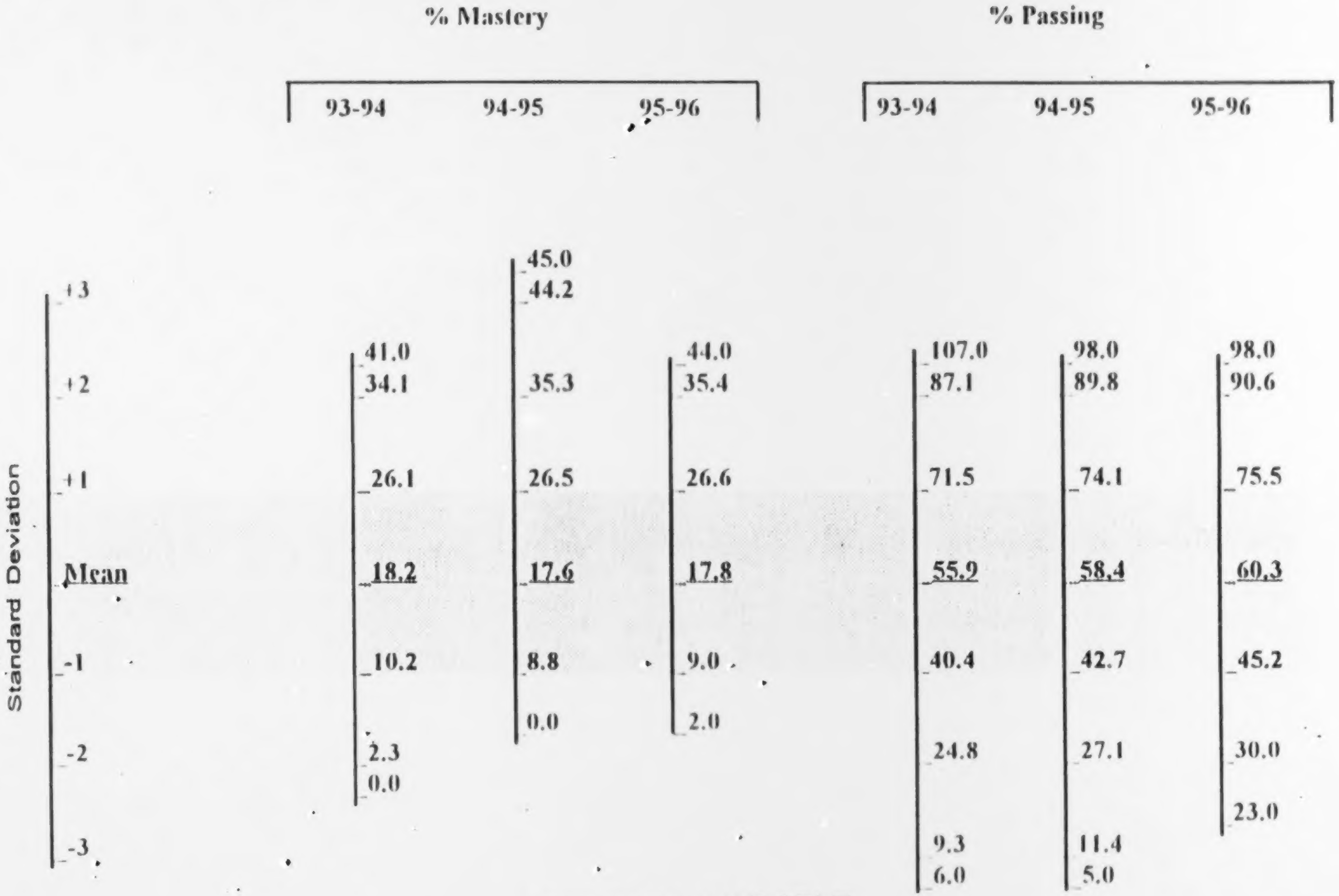
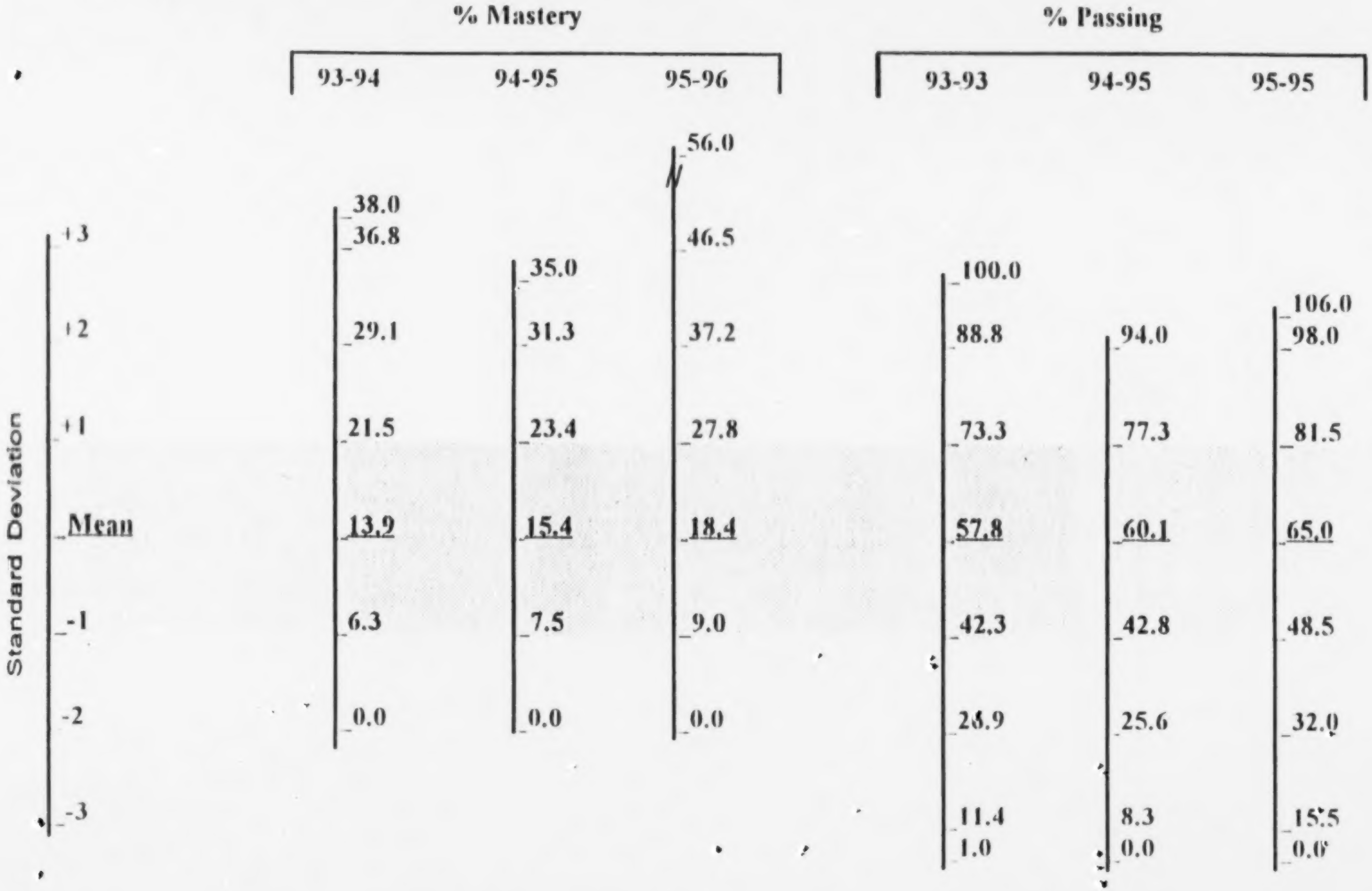
Achievement Chart IX. U. S. History & Government Regents Achievement (1993-1996)

This School———This District—— - —Similar Schools– – – – – –

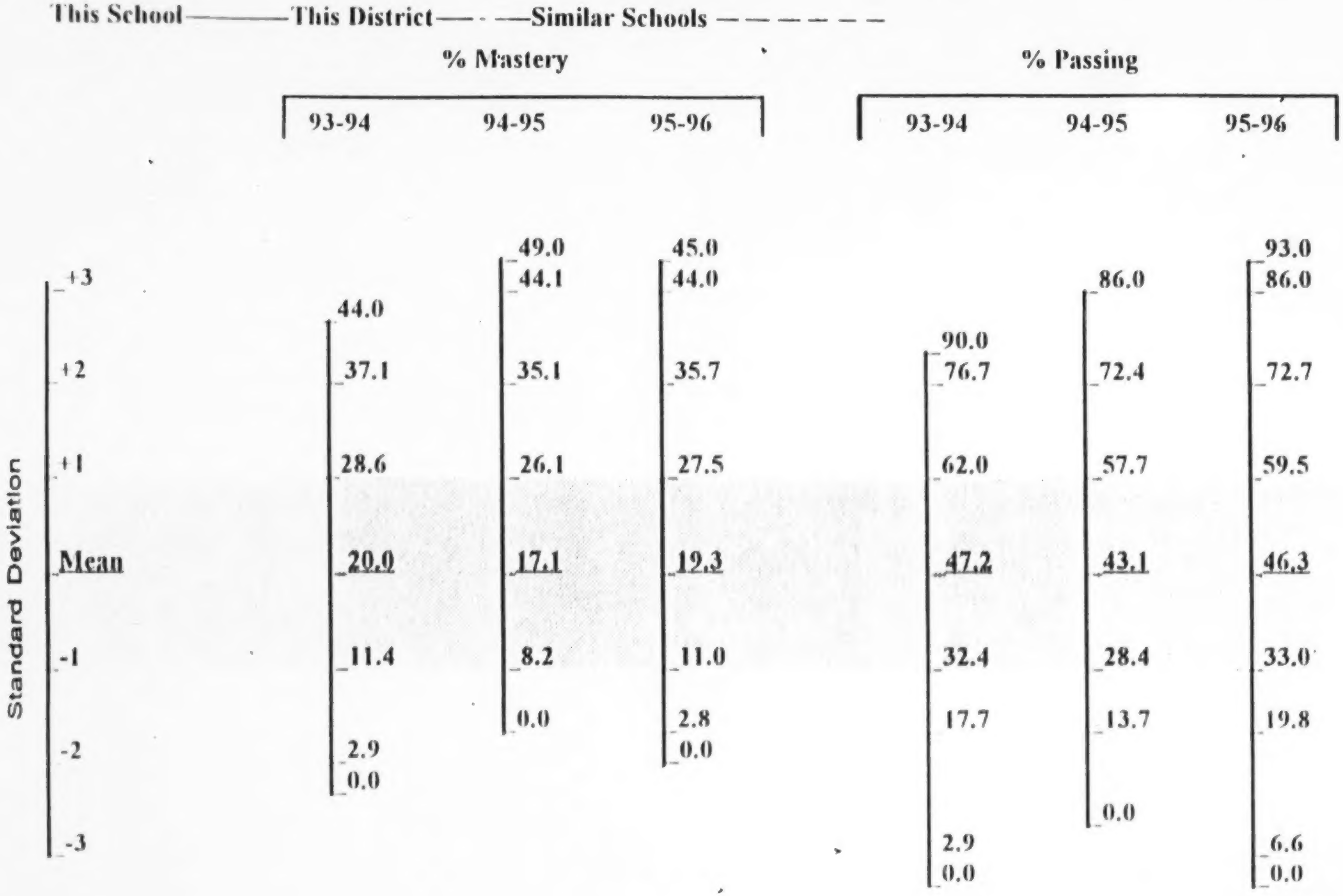


Achievement Chart X. Global Studies Regents Achievement (1993-1996)

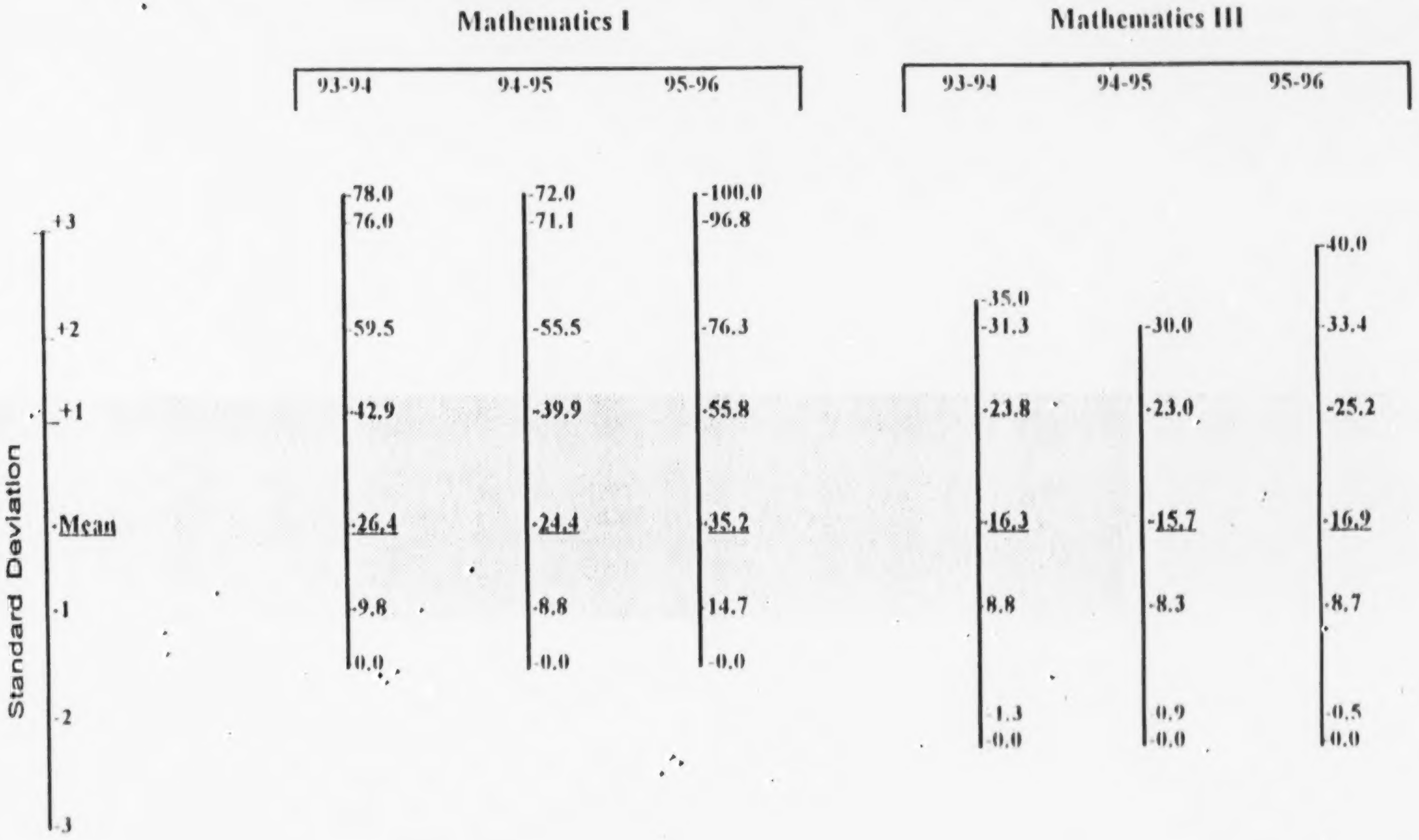
This School ———— This District —— - — Similar Schools — — — — — — —



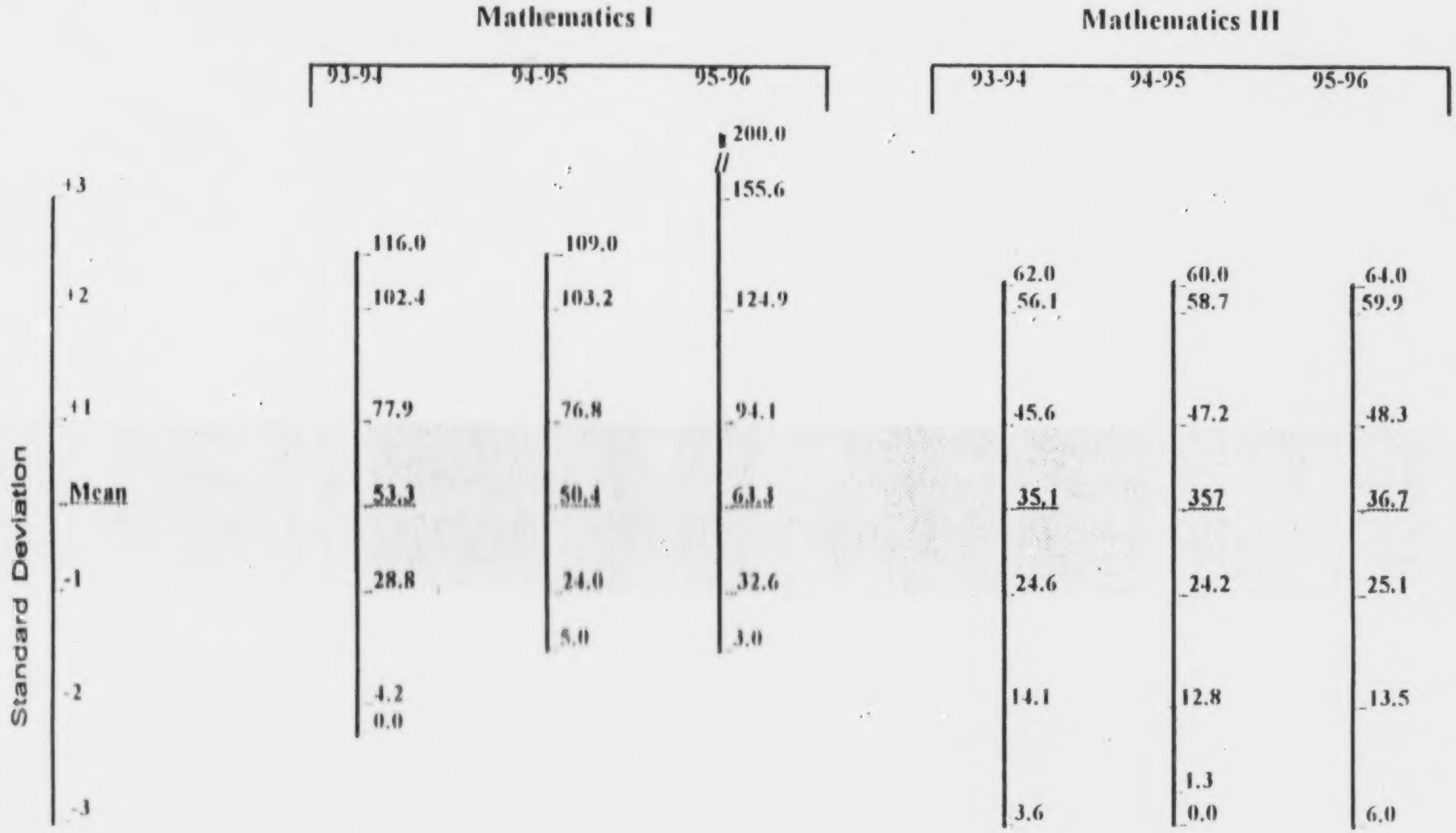
Achievement Chart XI. Languages Other Than English Regents Achievement (1993-1996)



Achievement Chart XIIA. Percent Mastery Mathematics I and III Regents Achievement (1993-1996)
This School———— This District—— - —— Similar Schools — — — — — —



Achievement Chart XIIB. Percent Passing Mathematics I and III Regents Achievement (1993-1996)
This School ——————— This District —— - —— Similar Schools – – – – – – –



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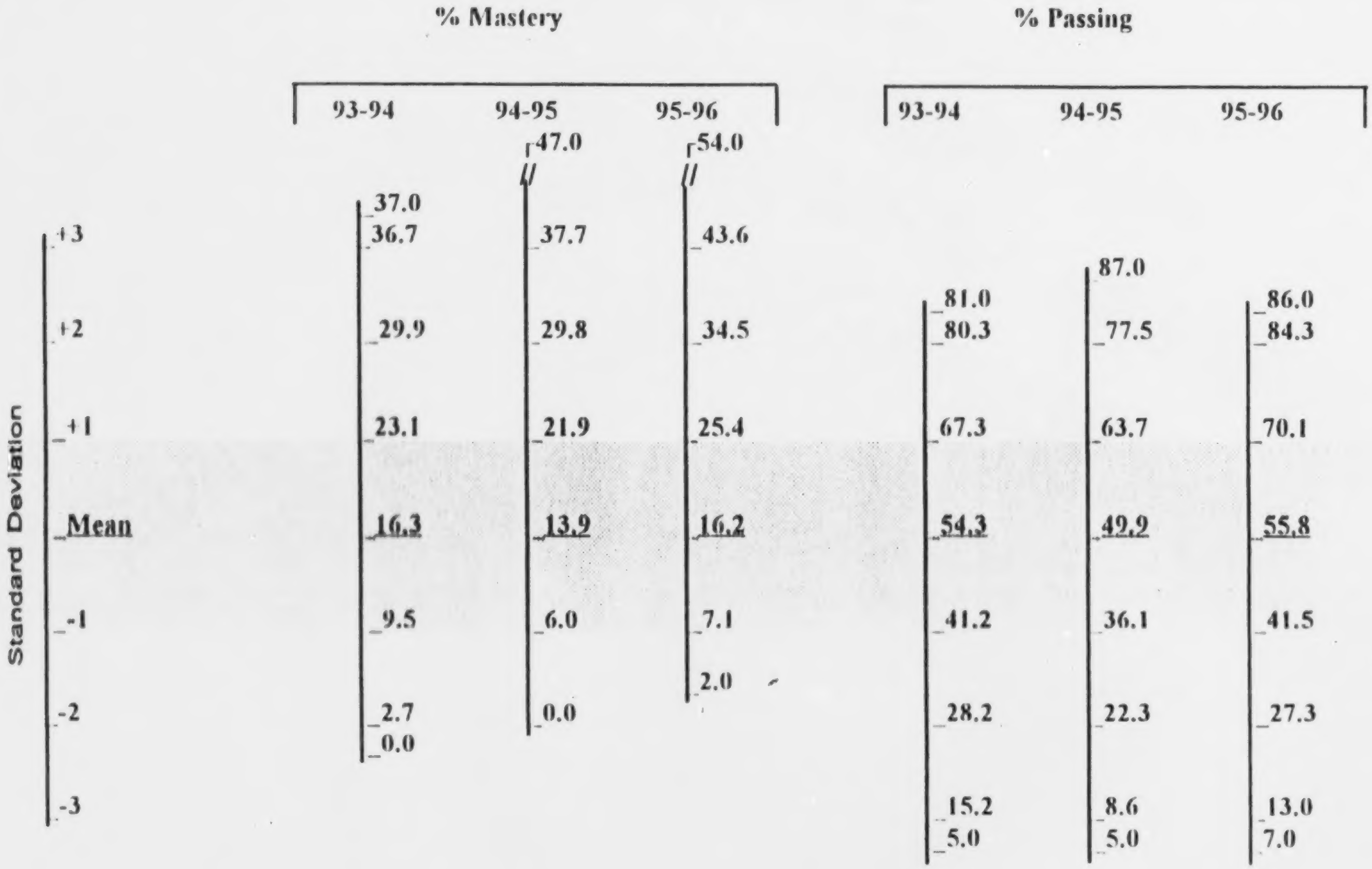
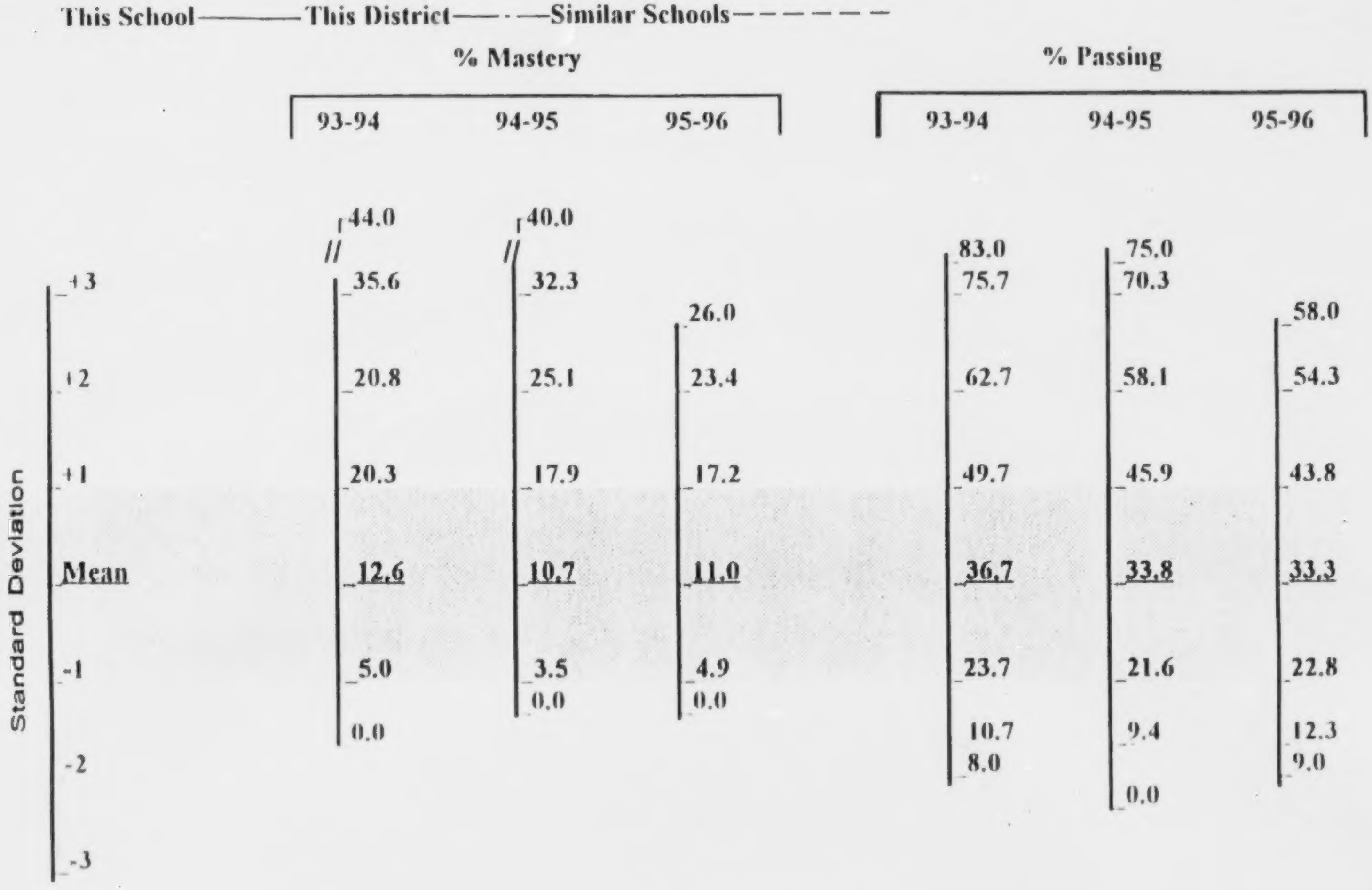
Achievement Chart XIII. Biology Regents Achievement (1993-1996)

This School——— This District— - —Similar Schools — — — — — — —

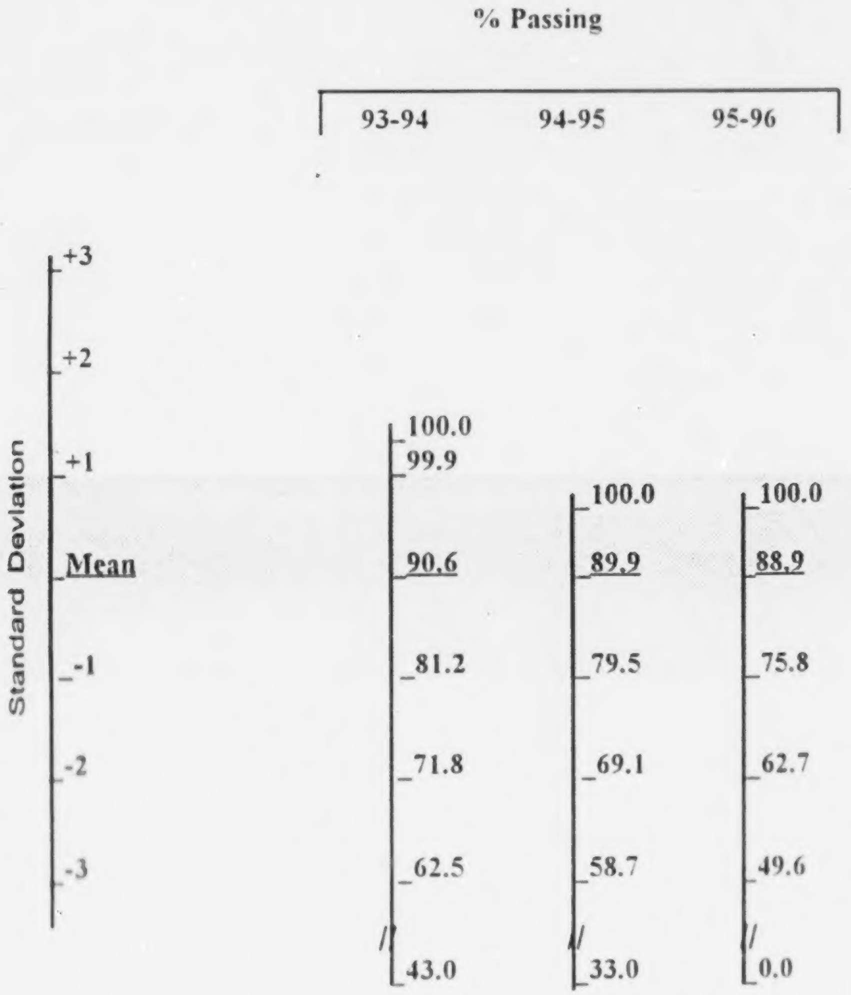


Achievement Chart XIV. Chemistry Regents Achievement (1993-1996)



Achievement Chart XV. Introduction to Occupations Regents Achievement

This School———This District— - — Similar Schools- - - - - - -



Appendix C

Standard Score Charts

of

Student Achievement

and

School Effects Statistics

for Schools and School Districts in the

Eight County Western New York Region

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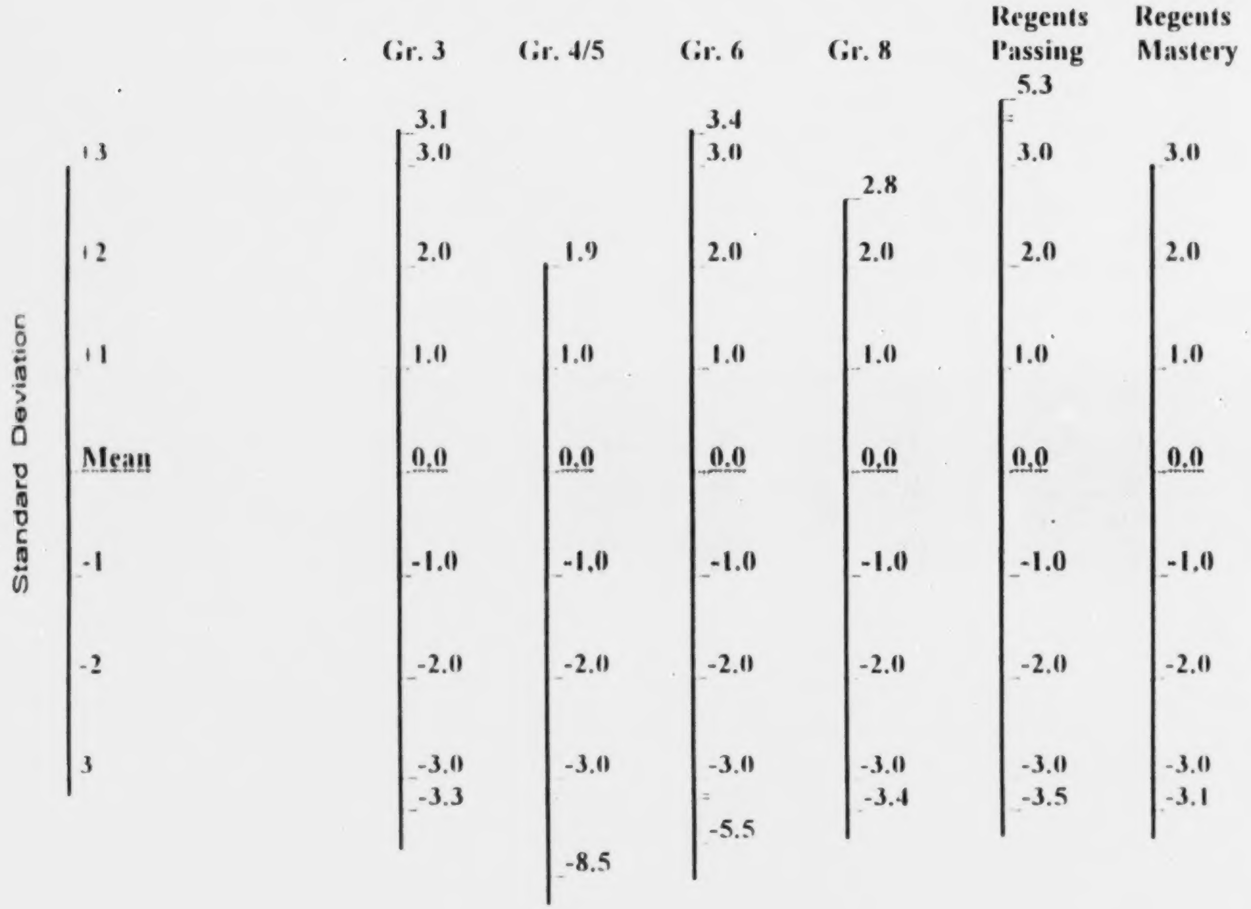
XVI. Aggregated Student Achievement and School Effect for Grades 3, 4/5, 6, 8 and Regents Examinations by School (in standard scores)

XVII. Aggregated Student Achievement and School Effect for Grades 3, 4/5, 6 and Regents Examinations by District (in standard scores)

Achievement Chart XVI: Aggregated Student Achievement and School Effect for Grades 3, 4/5, 6, 8 and Regents Examinations for Schools (in standard scores)

Student Achievement ——— School Effect -----------



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Achievement Chart XVII: Aggregated Student Achievement and School Effect for Grades 3, 4/5, 6 and Regents Examinations for Districts (in standard scores)